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ABSTRACT

This resource guide has been prepared to help middle school personnel infuse energy education into the basic education program of grades 6-8. The resource guide has two major sections. The first deals with the "why, what, when and where" questions of energy education including a set of objectives and concepts relative to energy education at the middle school level. The second section addresses the "how" question and includes annotated listings of curriculum guides, periodicals, organizations interested in energy education, audio visual materials, computer software, and Massachusetts energy statistics. (CW)

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ENERGIZERS

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A Guide to The Best in Energy Education Materials for The Middle Grades

SE 049 643

ENERGIZERS

A Guide to The Best in Energy Education Materials for The Middle Grades

January 1985

Education and Public Policy Department
Massachusetts Audubon Society

Produced Under the Auspices of a Grant From:
The Massachusetts Executive Office of Energy Resources
Michael S. Dukakis, Governor
Sharon M. Pollard, Secretary

The Commonwealth of Massachusetts
Executive Office of Energy Resources
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SECRETARY

(617) 727-4732

A Message From Secretary Sharon M. Pollard

Dear School Administrator and Educator,

The Executive Office of Energy Resources oversees the energy policies and the majority of energy programs in the Commonwealth. In this role, EOER supports the development of comprehensive energy policy which simultaneously increases our energy security and preserves our environment. All of our intiatives are directed toward achieving improved energy efficiency and the development of renewable energy resources.

Clearly one way to achieve our aims is to provide appropriate and adequate energy information to school age children in the Commonwealth. In this way we can help ensure that the future head-of-households and energy consumers make informed decisions related to their environment and energy consumption. EOER has, through its Energy Education Program which is operated by the Massachusetts Audubon Society, assumed an active role in advocating for the development of energy programs in Massachusetts schools.

A first and very important step is the development and dissemination of ENERGIZERS an energy education curriculum resource guide for junior high and middle school teachers. The resource guide represents a compilation of energy education curriculum and materials utilized by educators throughout the United States. This very valuable educational information is, for the first time, easily available to Massachusetts educators.

EOER and the Massachusetts Audubon Society invites you to join us in our goal to infuse energy education curriculum into our schools, and, in so doing, help create a sound energy future in the Commonwealth.

Sincerely,

SHARON M. POLLARD
Secretary of Energy Resources

SMP/CAT:dd

INTRODUCTION

Teaching youngsters the basic facts about energy and its impact on our lives is one of those fundamental things we all know should be done but which is apt to get sidelined in the press of daily life. When the media and the government proclaim that there is an energy crisis there is a scurry of activity, a rush to generate some curriculum materials, then a dwindling of effort when the "crisis" seems to be somewhat abated. However, energy management is eternally ongoing, and how we manage it affects how we can live our lives individually and collectively. Energy is basic to our daily lives, and the study of it must find a basic place throughout our schools' curricula.

This resource guide has been prepared to help school personnel infuse energy education into the basic educational program of the middle grades — six through eight. It assumes a broad diversity of educational approaches and the importance of the teacher in making instructional choices. It should be particularly useful to schools where administration and instructional staff are jointly planning to implement energy education over several years.

The resource guide has two major sections. The first deals with the **Why, What, When, and Where** questions of energy education including a set of objectives and concepts relative to energy education in the middle grades. These are not presented as the final word but as take off points for a school staff to tailor its own objectives and concepts for their curricula. The second section addresses the **How** question and includes annotated listings of curriculum guides, periodicals, organizations interested in energy education, potential field trip destinations, and audio-visual aids.

The three ring binder format will allow updating of materials and the addition of resources you discover from other sources and would like to keep in a central location. We are always eager to hear from users on ways this guide might be made more useful in future editions. Send your comments to:

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c/o Education and Public Policy Department
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Compilation of a resource guide such as this is of necessity a group effort that requires input from a number of people. I have drawn not only upon individuals in Massachusetts but have been greatly aided by the work of those in other states. Some have produced written source material but others have aided through personal consultation as well. I would particularly like to thank:

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To all these I extend heartfelt thanks.

Louise Maglione, Editor,
Energy Education Resource Guide

This select annotated guide to energy education resources was compiled by the staff of Massachusetts Audubon Society's Education and Public Policy Department under a contract with the Massachusetts Executive Office of Energy. The selections and omissions do not imply any endorsement by the State agency but are judgements of the MAS staff. The selections cover materials produced through 1984.

ENERGY EDUCATION
WHY, WHEN, AND WHERE

Energy runs the world. Without it nothing would get done; without a sound understanding of it — the sources, the unequal distribution and availability of much of it, the ways it is transported and used, and the political implications of wasting it — we cannot lead informed and effective lives. Obtaining and supplying energy generates pollution and other problems. Citizens need to understand this in order to make intelligent choices in the market place and voting booth; choices that will permit them to acquire sufficient energy to fulfill their needs and desires while maintaining an environment fit for life.

Education about energy must be part of the core of our efforts at schooling; not as a separate topic, but as an integral part of many disciplines where it is most appropriate. It should be infused throughout the curricula over the span of the school years. When energy education is mentioned there is a tendency for people to think — science. To be sure, there is a significant science component to energy education, but there is an equal role to be played by the social sciences in helping youngsters learn about the geography of energy sources, the history of energy use, the development and implementation of energy policy, and the skills of civic action. Home economics programs need to help students understand food energy and how to determine energy use of various appliances so that they can conserve both energy and dollars. Similarly, industrial arts programs should be helping students explore the energy requirements of tools and construction processes and how they can be reduced. Even sports programs can make a strong contribution by helping youngsters learn how to eat properly and make the most effective use of that food energy in any particular sport.

Awareness and understanding of energy and its role in our lives cannot be confined to academic disciplines if it is to be effectively taught. It must permeate the whole school environment. Energy conservation for the school building should be discussed and practiced by everyone, not just the custodian. Opening and closing of shades at the beginning and end of the school day, dressing appropriately so that thermostats can be set lower, shutting off unneeded banks of lights near windows and other such practices when discussed and routinely carried out, can establish and maintain an energy consciousness. In school field trips to learn about the operation of the school's energy systems — electrical, heating, food preparation — can be useful. Don't neglect to note design flaws that have made significant energy conservation difficult. Have students suggest how things might have been done better. Where feasible the students may even become involved in making energy saving changes, or at least recommending them. Students in Wallingford, Connecticut made recommendations that over two years saved the schools there more than 400,000 gallons of oil and over 3 million kilowatt hours of electricity. By investing $12,000, the schools there saved over half a million dollars.

Some teachers feel uncomfortable about undertaking energy education with their kids, feeling that their own education has left them ill prepared to do an adequate job. They find the texts they are using offer little about energy, particularly the non-science texts. ***It is unfortunate that society has taken so long to realize publicly the fundamental importance of energy to our lives and the need to have all future citizen basically informed about energy and its role in our lives.*** That delayed realization has put an added burden on society which must now pay a premium price for past failure and it puts a burden on educators who now must scurry about to address this educational deficiency in order to help correct society's energy mismanagement.

However, the sense of inadequacy felt by those teachers is generally ill founded; most already know much more about energy than they think they do, and with a little additional instruction they can do a creditable job of energy education. Of course, the more teachers learn about energy the better able they will be, not only to teach students but to manage and conserve energy in their own homes. Learning more about energy therefore has a double payoff.

An effective energy education program has to be based on a school-wide development and implementation plan. Materials must be examined, reviewed and selected; inservice workshops for teachers need to be planned and scheduled; a multi-year implementation schedule established and monitored with clear-cut objectives and evaluation guideposts. Energy education should be a warp thread woven into the school's overall curricula. This entails considerable work, but proper management of energy is so important to our society, now and for the future, that we must make the investment of time and effort. ***All the major teacher's organizations, administrator's organizations, and the association of school committees have produced formal statements favoring energy education. It is now time to move these statements from letterhead pieties to action programs.***

ENERGY EDUCATION — WHAT

Energy education is a developmental effort over many years. The basic concepts and skills are not learned all at once. This resource guide is focused on grades 6, 7, and 8 and on the skills and concepts relative to energy that seem to be most appropriate to the cognitive, affective, and skill development levels of youngsters in that age range. Youngsters at this stage of their lives are not adults, they should not have to wrestle with adult energy problems. They should however be learning how their world works and how energy affects their lives and those of other people. Energy education is one vehicle for helping these students with some of the tasks of middle school level intellectual growth such as:

- *developing ability to carefully examine and criticize information.*
- *developing disciplined and logical thought processes.*
- *developing the ability to communicate ideas and feelings through listening, speaking, reading and writing.*
- *developing ability to use their schooling in their personal lives.*

Activities involved in energy education at this level need to be as concrete as possible, and linked to things of strong interest to the students so that they can use them as vehicles for the tasks listed above. Wiles and Bondi, in their book The Teacher In the Middle School, put it well when they suggest that when designing instruction at this level one should think of oneself "less as the sage on the stage and more the guide on the side."

OBJECTIVES FOR MIDDLE GRADES ENERGY EDUCATION

Objectives for a middle grades energy education program fall into three primary categories: knowledge objectives, participation objectives and imagination objectives (those that challenge their mental abilities at imagery). The following set of such objectives may prove useful in planning your program.

Knowledge Objectives:

1. Students will acquire basic concepts of energy conservation, resources, and interdependence.
2. Students will acquire basic concepts of self and human behavior.
3. Students will acquire knowledge of basic processes of energy transformation and use.
4. Students will acquire basic knowledge of policy processes affecting energy decision-making and the impact of various alternatives.

Participation Objectives:

1. Students will learn basic steps in individual decision-making including information, choices, alternatives, applying values to alternatives, and determining consequences.
2. Students will experience individual decision-making in group settings in their school, home, and community related to energy conservation.
3. Students will develop skills in group decision-making, including identifying rules and appropriate strategies, implementing group decisions, and identifying consequences.
4. Students will gain experience in acting in group situations in their school, home, and community related to energy conservation.

Imagination Objectives:

1. Students will develop images of energy situations from their own personal experiences.
2. Students will share concrete descriptions of their images of energy situations with other students.
3. Students will use concepts to describe their imaginary situations, and share those with other students.
4. Students will apply the concepts they develop to their own everyday lives.

MAJOR ENERGY CONCEPTS FOR GRADES 6, 7, 8

To facilitate selection of content material for middle grade energy education the following list of energy education concepts is provided. These are adapted from those developed by the North Carolina energy curriculum. They are clearly not the only statement of such concepts but they provide a reference frame for developing your own local program.

The eleven concepts presented in bold-face below represent a core to be developed in the three-year span of grades 6, 7, 8. To develop them adequately with the learners will require input from several of the basic disciplines taught in these grades — science, social studies, and mathematics. Sub-concepts listed beneath the major ones are keyed to areas that seem most appropriate to deal with them, not only the major disciplines noted but home economics and industrial arts as well. Code: **S = science; SS = social studies; M = mathematics; HE = home economics;** and **IA = industrial arts.**

1. Energy is Required for Change. . .Biological and Physical.

1.1. Energy is the ability to produce motion or cause a change; it is the ability to do work. **[S]**

1.2. All living things require energy to carry on life processes (photosynthesis, respiration, metabolism). **[S]**

1.3. Atmospheric circulation is partly caused by the unequal distribution of solar energy. **[S]**

1.4. Forces of gravity and magnetism bring about changes on earth such as ocean currents, tides, and movements of air and water. **[S]**

1.5. Changes in matter can be either physical or chemical, but it takes some form of energy to induce them. **[S]**

2. Matter and Energy, Under Normal Conditions, are Neither Created Nor Destroyed, but Can Be Converted from One Form to Another.

2.1. Potential energy is energy at rest while kinetic energy is energy at work. **[S]**

2.2 There are many forms of energy such as heat, light, sound, electrical, mechanical, and chemical. **[S]**

2.3 Energy changes form in many ways as it passes through the bodies of living things and on through food chains and webs. **[S,HE]**

2.4 Energy changes form in many ways as it is used in machinery and industrial processes. **[S,SS,IA,HE,M]**

2.5 Light energy is converted to heat energy in the atmosphere and at the earth's surface. **[S]**

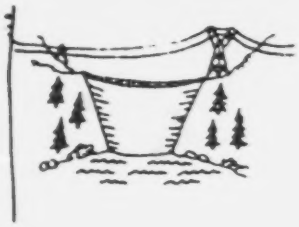
2.6 Through photosynthesis, light energy is used to change carbon dioxide and water into food molecules with chemical energy which organisms can use. **[S]**

3. When Energy is Transferred from One Form to Another, the Amount of Useful Energy is Reduced.

3.1. No machine is 100% efficient because in transforming one energy form to another some heat is generated which is not directly useable for the purpose of the machine. **[S]**

3.2. Efficiency of any machine affects the amount of energy needed to do a job and therefore the cost of operating the machine. **[HE,IA,S,M]**

3.3. In the flow of energy from the sun through the various steps (trophic levels) in food chains and webs, some useful energy is lost at each point of transfer. **[S]**



4. The Sun is the Primary Source of Energy for the Earth.

4.1. The sun is the initial source of energy in an ecosystem. **[S]**

4.2. Most energy sources can be traced back to the sun (e.g. wood, fossil fuels, wind, hydro, fission). **[S]**

4.3. The sun supplies us directly with various forms of radiant energy that are used directly or converted to other energy forms. **[S]**

4.4. The energy from the sun is responsible for most of the processes on earth such as weather phenomena, the water cycle, the carbon cycle, climatic conditions, and seasonal changes. **[S]**

4.5. Fusion is the principal process by which energy is produced in the sun. **[S]**

4.6. Energy produced on the sun, or other stars, travels through space as electro-magnetic waves. **[S]**

5. The Use of Energy is Necessary for the Operation and Survival of Any Society.

5.1. Since prehistoric times people have used fuels, in addition to food, to generate heat, light, and power and they will continue to do so in the future. **[SS]**

5.2. Throughout history cultures have periodically faced crisis in availability of their culturally dominant fuels. **[SS]**

5.3. Societies vary in their perception of acceptable fuels based in part on availability, cost, and ease of handling. **[SS,HE]**

5.4. Rates and amounts of energy consumption vary from country to country. **[SS]**

5.5. Industrialization depended upon the development of a number of inventions that could generate concentrated power from available fuels and harness that power to do useful work. **[S,SS,IA]**

5.6. Life style decisions affect energy consumption and energy-related decisions may heavily influence life style options. **[SS,HE,IA]**

5.7. Access to energy supplies affects the nature and success of all biological communities. **[S]**

6. All Sources of Energy are Limited in Some Way (Availability, Practicality, Application) and, Therefore, Pose Unique Utilization Problems.

6.1. Energy sources are not evenly distributed around the earth. **[S,SS]**

6.2. Forms of energy usable by organisms and ecosystems are limited. **[S]**

6.3. Living organisms solve problems in the utilization of energy by their special adaptations. **[S]**

6.4. Different energy sources are used for different jobs. **[S,HE,IA]**

6.5. The different energy sources generate a variety of pollutants in varying amounts which, depending upon their concentrations, longevity, and properties, affect human and other natural communities.**[S,SS,HE,IA]**

6.7. Solar energy tends to be diffuse and difficult to harness for use on a large scale though reasonably practical on a small scale for certain uses. **[S]**

6.8. Fossil fuels are formed by the sedimentation and metamorphic processes of the earth and are therefore finite and non-renewable on any human time scale. **[S]**

6.9. Hydroelectric generation of adequate amounts of power is limited by location of major natural rivers in suitable topography. **[S,SS]**

6.10. The use of tidal, wind, and geothermal energy sources depends heavily on location and the location's environmental factors. **[S,SS]**

7. Presently, Most Energy Requirements in Developed Nations are Met through Using Fossil Fuels (Coal, Oil, and Natural Gas) Which are Finite and Not Renewable on Any Human Time Scale.

7.1. Most electricity is generated using fossil fuels. **[S]**

7.2. Transportation modes using internal combustion engines depend primarily on fossil fuels to provide energy. **[S,SS]**

7.3. Fossil fuels are also in demand as raw materials for fertilizers, synthetic fibers, plastics, and medicines which sometimes raises a demand priority conflict for a scarce resource. **[S,SS]**

7.4. The supply of fossil fuels that we are using now was formed thousands of years ago. **[S]**

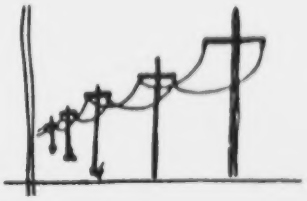
8. Alternative Sources (Direct Solar, Wind, Hydro, Biomass, Tidal, Fission, Fusion, and Geothermal) to Fossil Fuels are Available for Development to Meet Long-Term Energy Needs.

8.1. Development of alternative energy resources depends upon technological feasibility, geography, availability of investment capital, and cultural acceptance. **[S,SS]**

8.2. A number of solar related alternatives, such as wood and other biomass technologies, wind, and active and passive solar collecting devices are available today for small scale uses. **[S,SS]**

8.3. Young people growing up today have an opportunity to play key roles in the technological development and refinement of sustainable energy alternatives. **[S,IA]**

8.4. Each energy technology has negative impacts on the environment, and decisionmakers must make choices based on tradeoffs between legitimate energy demands and estimated environmental and human health degradation.**[S,SS,HE,IA]**



9. The Development, Distribution, Conversion, and Use of Energy Result in Environmental, Political, Economic, and Social Consequences.

9.1. An interrelationship exists between increased technology and energy consumption. **[S,M]**

9.2. Trade-offs must occur if conflicts among ecologically-sound practices, economic feasibility, political interests, and energy demands are to be resolved. **[SS]**

9.3. Geographical, environmental, and economic factors of a specific location influence the choice of the most viable energy source. **[SS]**

9.4. Unequal distribution of energy resources (particularly fossil fuels and wood at this time) causes major economic and social consequences for the "have"and "have not" nations. **[SS]**

9.5. Costs of energy resources are dependent upon availability. **[SS]**

9.6. Many causes of pollution (air, water, soil) are the results of substances being released into the environment during energy production and use.**[S]**

9.7. Overuse of the earth's resources (renewable and non-renewable) may have negative consequences for the quality of life and the environment's capacity to sustain our populations. **[S,SS]**

10. Energy Conservation will Extend the Availability of Energy Resources.

10.1. Improved technologies for extracting, processing, and utilizing energy resources such as coal, oil, and natural gas may help conserve our finite supplies of such resources. **[S,SS]**

10.2. Changing wasteful energy-use habits can reduce demand and thus extend finite energy supplies. **[S,SS,HE,IA]**

10.3. Energy conservation involves increasing energy efficiency and decreasing the amount of energy used. **[S,HE,IA]**

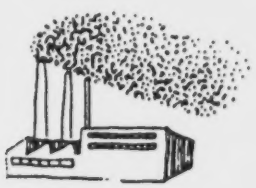
10.4. Energy conservation is an individual and community concern. **[S,SS,HE,IA]**

10.5. Products should be evaluated on the basis of energy efficiency. **[S,HE,IA,M]**

10.6. Recycling materials frequently conserves both energy and materials. **[S,HE,IA]**

10.7. Factors of community energy consumption can be influenced by committed individuals and groups. **[SS]**

10.8. Proper preventative maintainance of cars, mowing machines, home insulation, etc. helps conserve energy. **[S,HE,IA]**



11. The Needs, Attitudes, and Values of the Individual and Society Affect the Use of Energy.

11.1. Humans may choose to exploit or live in harmony with their environment. **[SS]**

11.2. The price of poor energy use today is paid in the future usually by a succeeding generation. **[SS]**

11.3. Future options of a society depend in large measure on energy use decisions made today. **[SS]**

11.4. Attitudes toward energy use and conservation vary with individuals. **[SS]**

11.5. Energy-related value decisions can be made based upon knowledge of available options and their potential consequences. **[SS]**

As overall, learner-directed goals for energy education it is anticipated that learners should understand that:

- there are many sources of energy.
- energy can be converted from one form to another.
- energy resources and their availability for human activity vary.
- there are many uses of energy.
- there are wise and efficient management practices which can extend the useful life of the earth's energy resources.
- energy development and use create impacts on environmental and economic systems.
- our energy future may be different from that of the past or present.

CURRICULUM INFUSION

With such objectives, goals and concepts as a working framework a teacher or curriculum team from a school is in a position to develop instructional plans that can be tied into a number of areas of existing curricula or can be built into energy education mini-courses if they so desire.

As an example of how the concepts might be infused let's take the case of a class studying Eskimo culture. They might simply add to their basic work the task of looking into the sources of energy used by that culture and the ways they manage a scarce resource. This would include such things as fuel, clothing design, food preferences, etc. Such a simple addition to the basic unit involves learning aspects of many of the conceptual statements listed earlier.

Examples from Eskimo Culture	Concept #
wood, fossil fuels, and other conventional energy sources are not available.	5.1, 5.2, 5.4, 5.7, 6.1, 6.2
whale and seal oil are major fuel sources.	5.3, 5.6, 5.7, 6.2, 4.3
animal fat is a major food item to gain needed calories.	2.3, 5.6, 6.2, 6.3
animal furs, with fur inside are used for clothing to conserve body heat.	10.3, 9.3, 6.3, 5.6
snow is a good insulator and can be used to construct energy conserving housing.	8.1, 9.5, 10.3, 10.4, 11.1
Inuit people have adapted physically to conserve body heat.	5.7, 6.3

This is just one example from many that could be chosen to illustrate how many concepts can be dealt with in only a small addition to a traditional unit. By such means a great deal of sound energy education can be woven into the overall program of the middle grades. The resource listings that follow give detailed information on hundreds of activities that can be utilized to build an energy education program that fits the needs of your classroom and school. Through careful planning you can use them to assure a citizenry of the future much better informed and aware of the role of energy in their lives and alert to problems and opportunities generated by energy utilization in any culture, past, present, or future.

ENERGY EDUCATION — HOW

Beginning in the mid-70's a considerable amount of energy education material was generated for all levels of education. In the haste to get out educational materials to meet the perceived energy crisis, a fair amount of the material left much to be desired educationally. As time passed much better materials were generated but funds to make them available dwindled as the "energy crisis" appeared to abate. The result is that some good, widely recommended materials, are no longer available. All of these things were considered in compiling this guide which deals with materials produced through 1984. For this guide, selection of the resources (including books, brochures, games, audio-visuals, computer soft-ware, and field trips) was based on the following criteria:

- Useability in an instructional atmosphere, that is, the material should be suitable for use by teachers and students in both formal and non-formal classroom settings.
- Relevancy to issues on energy use in the environment.
- Accuracy and up-to-dateness of energy facts and trends.
- Attractiveness of format, organization, illustrations and resources.
- Emphasis on curriculum material that calls for active student participation, both in and out of the classroom, and assumes little teacher background in most cases.
- Emphasis on energy conservation and quality of life.
- Availability, that is, teachers have easy access to all resources included in the guide.

Reviewers of the material were all experienced teachers and teacher trainers; furthermore, energy scientists read the material for technical accuracy. An advisory panel of five local and national energy education specialists and middle school teachers reviewed our final sections to be sure we had not overlooked some particularly valuable material or included materials grossly inappropriate to the grade levels.

The first part of the **How** materials focuses on the what are considered the top materials appropriate to this grade range. Each of the selections is quite comprehensive in its scope and as a group they represent a range of approaches to energy education. With these **Ten Top** programs you will find a comprehensive summary sheet that uses a checklist format to supplement the review. The summary sheet also includes a photostat of the cover graphics of the program. The summary sheet is immediately followed by a direct reproduction of a complete lesson from that program. This gives you an opportunity to examine the organizational and graphic style of the material and also gives you an activity to try out with your classes to see how it reaches the students.

The second part of the **How** materials includes other curriculum guides, many of which contain useful exercises but were judged not to be as broadly useful as the Top Ten. They may be dated or otherwise flawed, or they may be limited in their application. Besides such guides, this section contains a list of periodicals, audio-visual materials, computer software, field trips, and organizations that can help in the teaching of energy concepts.

Many of the materials included in this guide may be available free through the auspices of the utility company serving your school. Some utilities also have programs to help defray field trip costs to certain sites. The list of organizations in the second part includes the addresses and contact persons for most of the groups that provide such services.

TEN TOP
ENERGY
CURRICULUM MATERIALS

CONNECTIONS

NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY

1980, Copyright, Joan Melcher, Author

SOURCE: National Center for Appropriate Technology
Box 3838
Butte, Montana 59701

Grade Level: (5) (6) 7 8 9 **Cost:** $5.00

DESCRIPTION/CRITIQUE

A series of 10 lesson plans, introduces the student to the ways our energy, food, transportation and economic systems interact. The curriculum provides background information, lesson plans and student handouts. Each lesson plan includes suggested discussion topics, classroom activities, take home assignments, vocabulary and a brief quiz. There are more than enough ideas and suggestions for each classroom session, allowing the teacher to choose those best suited to her class. Many of the student hand-outs help illustrate the concepts set forth in the lessons.

Neither fossil fuels or nuclear energy are included as an appropriate technology here; a natural bias given the scope of the publisher. Regardless, a good source of interesting, well planned lessons, ideas and activities.

MATERIALS

Student Activities	X
Teachers Guide	
Background Reading	X
Spirit Masters	X
Transparency Maste	
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	X
Home Economics	
Industrial Arts	
Interdisciplinary	
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	
Interdisciplinary	X
Multidisciplinary	
Infusion	

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	
Investigations	X
Games	X
Simulations	
Group Discussion	X
Debates	
Demonstrations	X
Questions	X

TIME FRAME

Single Class	
Multi Class	X
Units	
Independent Study	

19

LESSON FIVE: RECYCLING

Objectives:

Students should be familiar with the rates paid in their area for recyclable items and be able to identify various wastes in their area that could be recycled to the economic and social benefit of the community.

Vocabulary:

industrial waste
bio-mass
compost

Discussion of Concept:

1. **Getting Cash for Trash:** Make copies of "A Very Short History of Trash" and pass them out to the class. Discuss the major points. Point out current obstacles to recycling. Note the recyclable material that currently is not being recycled in your area because of economics; compare to the hidden costs of waste: pollution, finding a place to bury or dump it, careless use of limited resources.

2. **Reports on Home Waste:** Discuss the students' findings. What is the most common area of waste? What items that can be recycled aren't? Do we often have a choice between a recycled container and a throw-away? What one material would the students choose to recycle that is not being recycled now?

3. **Industrial and Agricultural Waste:** Discuss industrial wastes in your community or area, such as by-products from manufacturing, wood ends from lumber mills, manure from stockyards, steam loss from a factory. Ask the students if they can think of a use for the waste or a by-product. (Examples: composting, bio-conversion)

Materials Needed:

Recycled paper from previous lesson

Class Activity:

1. **Field Trip to a Recycling Center:** Collect all the recyclable material and sort it properly (following instruction from the center). Visit the center with the students, having arranged in advance a time when a knowledgable person can discuss the economics of recycling. Ask where recyclable material is sent; how it is processed; what its next use will be.

2. **Field Trip to the City Dump:** The dump is an ideal spot to demonstrate needless waste. Have the students interview the person in charge. What items are most likely to find their way to the dump? Have they usually been fully used? Have students think of another use for one item they see at the dump. Give a prize for the most creative, workable idea.

Home Activity:

1. **Take Home Exercise:** Have students do exercises in "Do Returnable Bottles Save Energy?"

2. **Use the Recycled Paper:** Ask for volunteers to use the recycled paper for a poster or display for the classroom, or give interested students small sheets of the paper to make cards for an upcoming holiday.

Preparation for Next Lesson:

Gather art supplies for class activities you plan to do; you'll need beans or chips for the Energy Chain Gang.

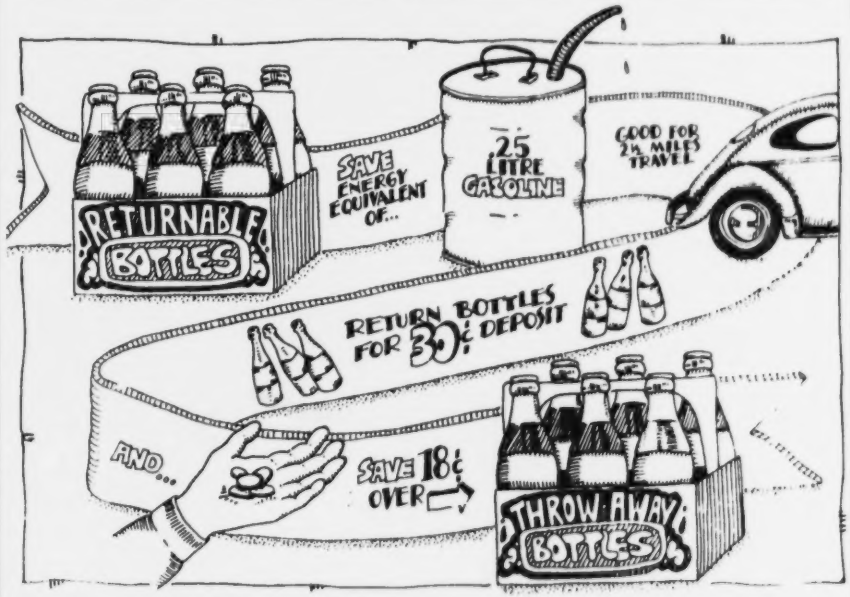
A VERY SHORT HISTORY OF TRASH

1 People have always had trash. Only Cavedwellers didn't have a big problem with it. In those days, there was plenty of room for trash. And nature easily disposed of it.
2 Today, trash is a big problem. More people mean more trash and more different kinds of trash. You name it – cans, paper, bottles, garbage, old cars, old clothes. In time it becomes TRASH.
3 Every year, each one of us throws away almost ONE TON of trash. If you piled this trash in your living room, it would come to your shoulders.
4 In one year, all our trash amounts to 360,000,000 tons. We have problems with trash that Cavedwellers never had. To get rid of it, we have tried to...
5 burn it. But burning trash can cause air pollution.
6 dump it in the ocean. But dumping can pollute the ocean, too.
7 bury it. But we're running out of empty land near cities.
8 Some scientists have even suggested shooting it off into empty space. But who wants old tennis shoes and pop cans orbiting the earth?
9 In the past few years, however, we have found a new way to get rid of some of our trash. It's called RECYCLING.
RECYCLE
Recycling means reusing our trash instead of getting rid of it. This solves the problem of what to do with our trash and it also helps us with another problem. By using the same materials over and over again, we save our natural resources.
Recycling means shredding old cans and cars and melting the pieces to make new metal for new cans and cars.
chopping up grass cuttings and garbage to burn for energy or to make fertilizer to help new plants grow.
crushing bottles into tiny glass bits and melting these bits to make new glass.

* Concept provided by McDonald's Corp.

BEST COPY AV

DO RETURNABLE BOTTLES SAVE ENERGY?



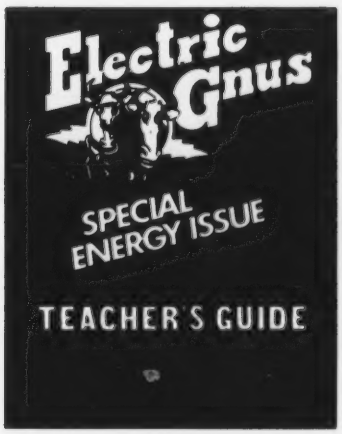
The purchase of a six pack of soft drinks in returnable bottles instead of no-deposit no-return containers will save the energy equivalent of 25 liters of gasoline. The saving of 25 liters of gasoline can take the average family car about 2 ½ miles. In addition, when the empty bottles are returned for a 30 cent deposit, the six pack purchase will have cost 18 cents less than for throw-aways.

1. If each family in the class purchased one or two six-packs of returnable bottles each week for one year, how much energy in gasoline will be saved?
2. Using the figure from No. 1, how many miles of automobile travel are possible with the energy which is saved?
3. How much money is saved?
4. Why do you think so many people still buy beverages in throw-away containers?
5. What do you think the government or people should do about this matter? What will you do?

* *From Iowa Energy Policy Council's* **Energy Conservation Activity Packet** Grade 6

BEST COPY AVAILABLE

ELECTRIC GNUS



INNOVATIVE COMMUNICATIONS, INC.

1980, Copyright by So. Cal. Edison Co., L.A. Dept. of Water and Power.
Sacramento Muni. Utility Dist.

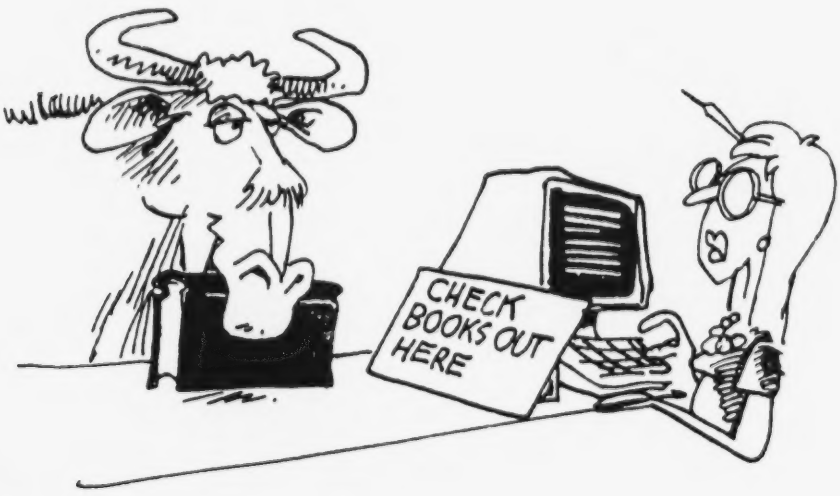
SOURCE: Innovative Communications, Inc.
2923 N. Main St.
Walnut Creek, CA 94596

Grade Level: 5 6 (7) (8) (9)

Cost: $28.25 class set:
TG & 40 work books
5.50 teacher training tape

DESCRIPTION/CRITIQUE

The student workbook in comic format presents 16 pages of facts and activities on energy supply and demand, limited resources, alternatives and their potential, load management and conservation. The teacher's guide is a resource manual and provides basic energy information, teaching strategies, tests, reproducible activity sheets, etc. The activities can easily be infused into existing curriculum and can be used with little or no teacher preparation. The teacher's guide has a good list of available resources, glossary and bibliography. The humorous nature of materials can be used to encourage student creativity.



MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	
Spirit Masters	
Transparency Masters	
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	X
Home Economics	
Industrial Arts	
Interdisciplinary	
Other (math)	X

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	
Interdisciplinary	
Multidisciplinary	X
Infusion	

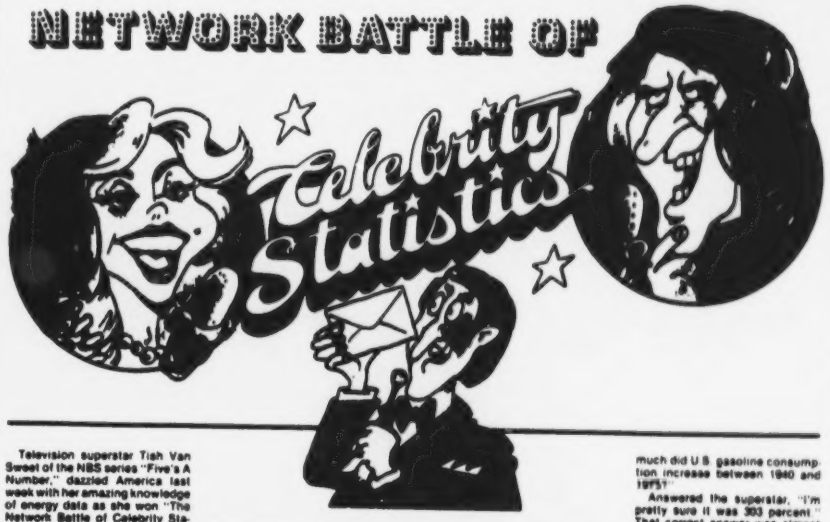
INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	X
Case Studies	
Investigations	
Games	X
Simulations	
Group Discussion	
Debates	
Demonstrations	
Questions	X

TIME FRAME

Single Class	X
Multi Class	
Units	
Independent Study	

NETWORK BATTLE OF Celebrity Statistics



Television superstar Tish Van Sweet of the NBS series "Five's A Number," dazzled America last week with her amazing knowledge of energy data as she won "The Network Battle of Celebrity Statistics."

She beat out sportscaster Mark Donner, who admitted he'd gotten to the finals mainly by his knowledge of athletics. "I thought energy conservation was getting lots of rest before a big game," said the ex-ballplayer.

It became obvious right from the start of the televised contest that Tish had the advantage in the category of energy, which was chosen as the show's theme. She rode a bus to the studio and immediately began weatherstripping her dressing room door.

"I know enough about energy to be aware that we don't have any to waste," she remarked to show host Lance Boyle as the contest began. "I guess I was born to conserve—I don't even have to use an electric curler, because I have naturally wavy hair."

Showing her understanding of America's limited energy resources, Tish won the first round by knowing that the amount of electricity produced in the U.S. increased more than 2300 percent between 1930 and 1980. "That's about ten times faster than the population grew, showing we are a nation that depends heavily on electricity," she observed.

Mark also made points when he correctly said that over 60 percent of U.S. electricity is produced by burning either coal or oil. But then he missed answering a question about how many barrels of oil the U.S. used to generate electricity in 1930 (6,804,530) compared to 1975 (506,128,000).

Tish quickly supplied the answer. Then she pointed out that "The big jump in the amount of oil burned to generate electricity makes it obvious that conserving electricity can also help to conserve on oil."

Next, Mark correctly fielded a question on "water power" by telling the audience that the percentage of electricity generated by hydro power dropped from 30 percent in 1930 to 15.6 percent in 1975.

But he blew it by saying that the total amount of hydroelectric power decreased during that period. "Actually it went up quite a bit," explained Tish, "but other power sources grew even faster." Show host Lance Boyle stopped smiling long enough to explain that one reason why more hydroelectric power plants hadn't been built was the decreasing number of damsites available to store the water needed to run the plants.

"That must be why we're burning up so much more fuel as demand grows," reasoned Mark.

The next question aimed at Tish was, "Which power source had the greatest increase in use during the 1970's?" She quickly answered "Nuclear . . . it grew by more than five times in ten years."

Commented Mark, "I wish I owned a uranium mine," to which Tish replied, "They're using a lot of coal these days, too."

Mark missed the next question, which was "In addition to oil, coal, water and uranium, what is the other major fuel that is used to generate electricity?" Answered Mark, "It must be the sun," which Boyle explained was wrong.

"The correct answer," said Tish, "is natural gas." "But," she added, "with improving technology, they expect to see a gradual growth in the use of solar power and other alternative energy sources in the years ahead. Some day they also predict there will be much less oil burned to generate electricity."

Added Mark, "That sure would be neat. It would leave more oil for making polyester leisure suits!"

"But Mark," said Tish, "that's not the point. We can't replace oil, and the amount we have left is getting smaller and smaller. The whole idea is to use as little as possible."

"Which brings us to the next question," said Boyle. "Tish, how much did U.S. gasoline consumption increase between 1940 and 1975?"

Answered the superstar, "I'm pretty sure it was 303 percent." That correct answer was almost enough to win the contest for her.

The final blow for Mark came when Tish told the nationwide audience that in 1978 Yugoslavia used 51.3 billion kilowatthours of electricity, Canada consumed 339.7 billion kilowatthours, the USSR used 1.2 trillion kilowatthours, and not to be outdone, the United States outconsumed the rest of the world with 2.21 trillion kilowatthours.

"It sure looks like that gives us plenty of chance to conserve," commented Mark. "I think I'll start by not reporting on any more night baseball games, and keeping the air conditioner in the booth set at 78°."

"Well, every little bit helps," said Tish as the pair finished the contest. "Until we can come up with some new ways to meet growing energy demands from all segments of the community, everybody's going to have to do their part to help ease the load on our electrical systems."

"That gives me an idea," said Mark. "How about coming over to my place next Saturday, and helping me insulate my attic."

Answered Tish, "Well, that's certainly a new one. What time?"

KILOWATTHOUR (kWh)—a measure of work performed by electricity, equal to the use of 1000 watt hours. Burning ten 100-watt light bulbs for one hour uses 1 kWh of electricity.

STAR STUMPERS

Here's the data bank that both stars were supposed to study before "The Network Battle of Celebrity Statistics" show. Complained Marvin, "I was too busy putting on my makeup. And besides . . . I need bifocal cue cards."

Anyway, the tables below contain all the information for our own "Celebrity Statistics" contest. Answer the questions at the bottom of the page correctly and win one of the following fabulous prizes:

3rd PRIZE — A Mark Downer Poster
2nd PRIZE — A Tish Van Sweet Poster
1st PRIZE — Neither one

Deadline for entries: The day before yesterday.

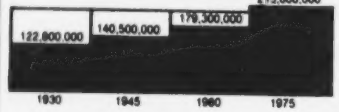
Production of electricity in United States (millions of kilowatthours)

1930	91,112	2005% growth from 1930-1975
1945	141,837	
1960	753,350	
1975	1,917,638	

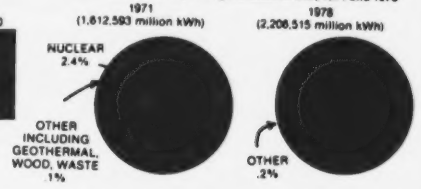
Amount of oil consumed for electrical power generation in U.S., 1930-1975

1930	8,804,530 barrels	5648% growth in oil consumption, 1930-1975
1945	20,228,215 barrels	
1960	85,340,108 barrels	
1975	506,128,000 barrels	

United States population growth, 1930-1975



Sources of electrical power generation in U.S., 1971 and 1978



U.S. gasoline consumption, 1940-1975 (millions of gallons)

1940	25,824
1945	32,944
1950	42,798
1955	57,301
1960	64,055
1965	73,770
1970	90,955
1975	104,154

Production of electricity in selected countries, 1978 (billions of kWh)

United States	2,206.52
U.S.S.R.	1,200.00
Canada	335.71
Spain	99.26
Norway	81.11
Yugoslavia	51.34

% of U.S. electrical power generated by hydroelectric sources, 1930-1975

1930	30%
1945	36%
1960	19%
1975	15.6%

QUESTIONS:

1) a. How many barrels of oil did the United States consume for electrical power generation in 1930? _____
   b. How many in 1975? _____
   c. How many more barrels did the United States consume in 1975 than in 1930? _____

2) a. What percentage of America's electrical power was generated by hydroelectric sources in 1960? _____
   b. How many millions of kilowatthours of electricity were generated by the United States in 1960? _____
   c. How many millions of kilowatthours of electricity were generated by hydroelectric sources in 1960? _____

3) a. In which year did the United States consume 104,154 million gallons of gasoline? _____
   b. What was the population of the United States in that year? _____
   c. What was the per capita consumption of gasoline in that year? _____

4) a. How many millions of kilowatthours of electricity were generated in the United States in 1978? _____
   b. If Romania's electrical power generation was 2½% of the United States' in 1978, how many millions of kilowatthours did Romania produce? _____
   c. According to the chart above, Romania's electrical power generation was greater than _____ (country) but less than _____

Celebrity Statistics

Gnus, pp. 4–5
Key Energy Topic: ENERGY SUPPLY AND DEMAND

You don't have to be a celebrity to make this lesson a winner. It's no secret that increasing demand for power and decreasing supply of energy resources mean that we are faced with some hard choices in our energy future. "Celebrity Statistics" graphically illustrates some of the quantitative aspects of the problem.

Social Science

The questions at the bottom of page five of the workbook engage the students in two basic skill activities, requiring them to work with the information provided in the tables above. This exercise can serve as an introduction to data identification and data analysis, skills of constant use in a variety of disciplines, and certainly of value in the study of social science. The answers to the questions are as follows:

1) a. 8,804,530 barrels (NOTE: one barrel = 42 gallons)
   b. 506,128,000 barrels
   c. 497,323,470 barrels
2) a. 19%
   b. 753,350 million kilowatthours
   c. 143,136.5 million kilowatthours
3) a. 1975
   b. 21,3 600,000 people
   c. 487.6 gallons per capita
4) a. 2,206,520 million kilowatthours
   b. 55,163 million kilowatthours
   c. Yugoslavia, Norway (and Spain, Canada, etc.)

The data provided on the growth of population, and on the consumption of electricity and gasoline, lends itself to the examination of changing lifestyles, based on the increase of per capita energy use. You can either design some problems to highlight this phenomenon or have the students make some observations based on the data, and then provide the numerical evidence to support their contentions. Additional data research using resource books, such as almanacs, can be assigned subsequently. NOTE: It is important to point out to the students that such data as the declining percentage of hydroelectric power generation between 1971 and 1978 can be misleading. It does not mean, for example, that the *amount* of hydroelectric generation declined, but rather that its significance diminished in relation to the vastly expanded total amount of energy produced—and consumed!

Once the number games are out of the way, a nitty gritty social science activity becomes obvious, i.e. a comparison of lifestyles between 1920 and 1980. The students might either do library research or interview a senior citizen for a first hand account to gain insight on energy use sixty years ago. Have them construct a hypothesis on some aspect of lifestyle changes based on increased energy consumption. The growth of suburban America, for example, is directly related to greater mobility, based on more people driving more cars which use more gasoline.

Another important point to note is that a large percentage of the energy used in the United States today is in the fields of transportation and food production. And that a significant portion of this use goes into the supply of manufactured goods and foodstuffs for other countries. With this in mind, you might have the students discuss the political and economic advantages and disadvantages of using energy resources to provide these commodities for foreign nations (e.g. depleting petroleum reserves vs. the international goodwill to be gained or the improvement in the national balance of payments).

Finally, the students can look at what future alterations in living patterns might take place due to limited or changing energy supplies. Have them suggest how their lives will differ from their parents, and how willing they will be to make the necessary changes.

Math (Skills 1,2,3,4,5,7)

Any page with as many numbers on it as page five of the workbook is bound to be a veritable gold mine of math exercises. Basic computational skills can be practiced in a host of ways. One suggestion would be to have the students compute the percentage increase in electricity production from 1930-1945, etc., or, given the population for such a year as 1960, have them determine the per capita gasoline consumption.

A more sophisticated comparison problem would be to have the students compare the percentage increase in U.S. population to the percentage increase in U.S. oil consumption for the years 1930, 1945, 1960, and 1975. The two sets of figures could also be graphed using different colors. To further extend the activity, have them do the same comparison with another country and then see what they can infer from this data vs. that of the United States. (Note: Along this line, you may wish to use the Repro Section activity on page 28, which was designed to be an extension of "Celebrity Statistics.")

Another dandy activity that can be spun-off from the data is to have the students hypothesize the most recent figures available in an almanac for one of the tables provided on page five. Such a projection should be based on an extrapolation of the figures for the preceding dates, plus any recent developments which might have altered a given trend. (For example, "I estimate the percentage of hydroelectric power generated in the U.S. in 1980.") The significant point of the exercise is not whether or not their guess is terribly accurate according to the latest almanac, but rather how well the activity works to provide an opportunity to deal with raw data and see how to use it in a functional manner.

- Construct an energy sources bulletin board, featuring newspaper and magazine articles on current and future supplies and displaying the pertinent data in charts and graphs.

- Present a specific energy-related problem to the students and have them suggest the type and source of the data necessary to answer the question.

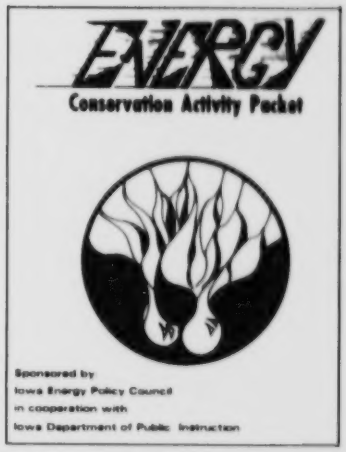
Another great source of local data is your own electric or gas utility. Such information as that which appears in an annual report or statistical supplement can be used for many computational and graphing problems. Other origins of data include oil companies, governmental agencies and fact-filled magazine articles which can be uncovered via the *Reader's Guide to Periodic Literature*. Remember, however, that it is also an educational experience for the students to fail occasionally in their quest for data—certainly not often enough to discourage them from researching, but at least sufficiently to point out the difficulties which sometimes arise when one needs specific information.

Science

The subject matter of this activity opens the door to the study of the relationship between energy sources and the delivery of electric power to the people. A good approach to such a study might include having the students research the energy source mix currently employed by their local electric utility. Next they could gather data on the mix, going back over several year intervals. Finally, they could investigate the problems faced by the utility in meeting future demands for electricity, considering the availability of energy sources, environmental concerns such as air pollution standards, and the feasibility of using new technologies. Another possible extension of the focus would be to examine how the various sources are converted into electric power.

Science classes might also investigate the whole question of energy efficiency as it pertains to various sources of power, and energy transmission. In other words, students might study the energy losses involved in electrical generation and transmission—and the alternative uses of fuels—such as using oil for making plastics, fertilizer, paint, or coal for pharmaceuticals and chemicals.

ENERGY CONSERVATION ACTIVITY PACKET



IOWA ENERGY COUNCIL/IOWA DEPARTMENT OF PUBLIC INSTRUCTION

1980, No Copyright

SOURCE: Iowa Department of Public Instruction
Information & Publications
Grimes State Office Building
Des Moines, Iowa 50319

Grade Level: (5) (6) 7 8 9 **Cost:** $12.50 Set
$ 2.50/ volume

DESCRIPTION/CRITIQUE

These instructor guides each begin with the goals and objectives for energy conservation, and the teachers may choose those activities which they feel will accomplish their objectives. They contain many value-choice type activities. Individual, small group, and family activities are included with student outcomes clearly stated. Familiarity with teaching techniques assumed; some energy background information is included. The level of skills needed for some activities is inconsistent with the concept and/or vocabulary level. Materials are arranged in binders for grades K-2, 3, 4, 5, and 6. The teacher should look at lower grade level activities, as well as that of the grade taught. Some activities require 20 minutes, others 40, and all include good supplemental material. Covered are energy use and sources, conservation, and lifestyles. A useful, well-organized collection.

MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	
Spirit Masters	X
Transparency Masters	X
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	X
Home Economics	
Industrial Arts	
Interdisciplinary	
Other (language arts)	X

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	
Interdisciplinary	X
Multidisciplinary	
Infusion	X

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	
Investigations	X
Games	X
Simulations	X
Group Discussion	
Debates	
Demonstrations	X
Questions	

TIME FRAME

Single Class	X
Multi Class	
Units	
Independent Study	

C. Make a list of industries and products which are now dependent upon fossil fuels that will not be able, in the future, to switch to other energy sources. (1.5)

D. Show *Transparencies #1-4, pp. g-j*, to help students see a total picture of what is going on with energy in the world. Discuss and use wall maps too. (1.5)

Goal 2.00 The learner will develop a conservation ethic in regard to energy.

Objective 2.1 The learner recognizes that every decision made involving energy affects standards of living.

A. Write letters to the major industries in your community. Write letters asking them to describe their approach to energy conservation. (2.1)

B. Use a tape recorder to ask family and friends what they have done to contribute to the solution of an energy shortage. Play back in class and discuss. (2.1, 2.8)

C. Student Reports--Famous Scientists

Using *Master #6, pg. k*, as a guide, students will study the lives and scientific accomplishments of renowned energy researchers. (2.1)

D. Distribute copies of *Master #7, pg. l*. This exercise will help students in making value judgements. After the students have completed the sheet, discuss the ranking they have done. (2.1)

Objective 2.2 The learner becomes aware of how social pressures to have things and use energy are created.

A. Have the class study magazine advertisements about energy and power. Then have them create ads from the positions:

1. Environmentalist
2. Mother Earth
3. Power Producer
4. Business person

These ads could be presented to a group of parents. Ask the parents for their reactions, thus creating a discussion. (2.2)

B. Invite a speaker from an environmental group, a government agency, and a local power company to talk about energy problems in the community. The students should prepare questions ahead of time for a question and answer period.

C. Values Sheets--Values Clarification Activity

Provide students with copies of the Values Sheets (*Masters #8, 9, pp. m-n*). These are to be completed individually and handed in. They would serve as a form of evaluation as to the effect of a study of energy on the student's attitudes. These can be used as pre- and post-activities. (2.2)

D. Values Continuum--Values Clarification Activity

The teacher identifies an issue (see suggestions, or make up your own) and draws a long line on the board. Then place the two polar positions and mark a series of points along the continuum. Say, "Between the end points there are many positions. I am going to whip quickly around the room and ask you to tell me where you stand on this issue. Briefly describe your position without giving reasons. You may pass if you wish."

If clustering occurs, you may wish to have the students write the answers on a piece of paper and the teacher randomly selects a few to be placed on the board. Discuss. (2.2)

Suggestions

1. What should the U.S. attitude be toward energy sources in other countries?

PURCHASE ALL ENERGY FROM OTHER COUNTIRES	.....	PURCHASE NO ENERGY FROM ANY COUNTRY

2. How much do you watch TV?

BLURRY-EYED BILL-- Never Turns It Off	.....	NO-KNOB NED-- Never Turns It On

3. How do you feel about automobile transportation?

AUTO-GO Use for Everything	.....	AUTO-QUIT Use As Little As Possible

Objective 2.3 The learner realizes that individuals may band together to effect choices in the social, economic, and political realms.

A. Divide the students into groups to study the energy problem. Have each group appoint a recorder, math consultant, and researchers. The recorder keeps accurate records of everything, the researchers inform the group of news items, TV broadcasts, and conduct surveys. The math consultants meet with the teacher to make certain they can work the problems and then make sure that each member of the group knows how to work the problems. (2.3)

Energy Activities
Grade 6
Packet "A"
Master #6
Activity C, 2.1, pg. 9

STUDENT REPORTS

Choose one of the following men of science who worked on some kind of energy:

Isaac Watt	E. O. Lawrence	Enrico Fermi
Michael Faraday	John Cockcroft	Ernest Rutherford
Albert Einstein	Lise Meitner	Benjamin Franklin

If you know of another one you may use that is not on the list, please check it with your teacher.

Your report should consider the following questions:

a. What was there in the life of the man you have chosen that interested you?

b. For what things did you admire him most?

c. What exactly did he achieve?

d. What difficulties did he have to undergo to achieve his goals?

e. Where did he make his greatest contribution?

f. Who benefited from this contribution?

g. Are the benefits still present today?

Energy Activities
Grade 6
Packet "A"
Master #7
Activity D, 2.1, pg. 9

VALUE JUDGEMENTS RANK ORDER

Which of the following do you consider to be the most important? Use the spaces at the bottom, and the scale, to rank the statements.

Scale: 1 = most important
9 = least important

a. Pure water

b. Clean air

c. Lower noise levels

d. Conservation of natural resources

e. Living an environmental life-style

f. Elimination of litter

g. Wise buying practices

h. Use less energy

i. Be aware of the environment

1. _____	5. _____	9. _____
2. _____	6. _____	
3. _____	7. _____	
4. _____	8. _____	

Energy Activities
Grade 6
Packet "A"
Master #8
Activity C, 2.2, pg. 10

VALUES SHEET

Name _____

It is estimated that the aluminum industry uses 7% of the nation's total energy. Recycling of aluminum requires only 5% as much energy as must be used to produce aluminum from its ore.

1. What does this statement say to you?

2. Do you buy soft drinks in bottles or in cans?

3. In what ways do you try to recycle the aluminum cans you buy?

4. How important is it to you to recycle things?

5. If you plan to make any changes in your ways, please say what changes you will make. If you do not intend to make any changes, write "No Changes."

Energy Activities
Grade 6
Packet "A"
Master #9
ctivity C, 2.2, pg. 10

VALUES SHEET

Name _____

A car weighing 5,000 pounds uses over twice as much fuel as one weighing 2,000 pounds. Accessories such as air conditioning and automatic transmission contribute to fuel consumption.

The average car driven at 75 to 80 mph will consume twice as much fuel as the same car driven at 50 mph.

1. How do these two statements make you feel about the size of your family car and the speed at which it is driven?

2. What can you do about the size of your family car?

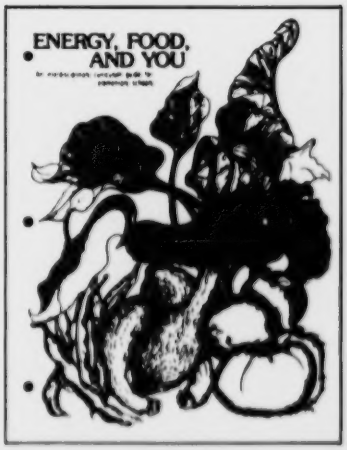
3. What can you do about the speed at which your family's car is driven?

4. How important is it to you that people drive smaller cars and drive slower?

5. What are some of the other things which could be done to save energy in transportation?

6. What are you going to do to help others realize the problems?

ENERGY, FOOD, AND YOU



WASHINGTON STATE OFFICE OF PUBLIC INFORMATION

1979 rev., No Copyright

SOURCE: Energy Food and You Program
Washington State Office of Environmental Education
2000 N.E. Perkins Way
Seattle, WA 98155

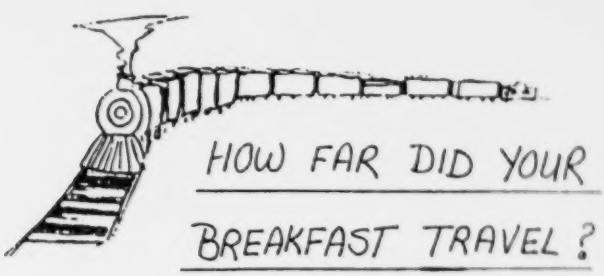
Grade Level: (5) (6) (7) (8) (9) **Cost:** $5.00/ per volume

DESCRIPTION/CRITIQUE

These two large guides for Grades K-6, 7-12 are an excellent source of information and activities on factors dealing directly or indirectly with food production and related energy topics. Included are the non-renewable sources of energy used in food production and distribution, "hidden" energy requirements of the food system, the environmental impact of food habits, nutrition, the need for more efficient fossil fuel use, and the need for more reliance on renewable source. Each guide is divided into three sections, Global Food and Resource Needs, Energy and the U.S. Food Systems, and Energy Efficient Nutrition.

The activities are arranged by concept and cross-indexed by subject. The lessons and other ideas for creative teaching can be infused into an existing course of study, taught as a unit for the appropriate level and discipline and/or used for independent study. The format for each activity includes the concept and subconcept addressed, discipline, grade level, objectives, materials required, procedures, bibliography and resources. Some even include comments.

A few lessons are oriented to the Northwest and/or the State of Washington, but, are easily adapted. A few references may be dated.



MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	X
Spirit Masters	X
Transparency Masters	
Equipment	
A/V	

SUBJECT EMPHASIS

Science	
Social Studies	
Home Economics	
Industrial Arts	
Interdisciplinary	X
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	
Interdisciplinary	
Multidisciplinary	X
Infusion	X

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	X
Case Studies	X
Investigations	X
Games	X
Simulations	
Group Discussion	X
Debates	
Demonstrations	X
Questions	X

TIME FRAME

Single Class	X
Multi Class	X
Units	
Independent Study	X

ACTIVITY TITLE: Mottoes and Meat; "You Are What You Eat!"

CONCEPT: The human body is dependent on food as a source of fuel for all life-sustaining activities.

SUBJECT AREA: Social Studies, Art, Health

GRADE LEVEL: 4th, 5th and 6th

OBJECTIVES:

1) To consider the energy resources required for our energy/nutrient needs.

2) To design a shield showing several processes a food goes through which require energy.

Note to the teacher - You may want to discuss the history of family shields and mottos if you haven't used the shield idea before with students.

ACTIVITY:

1. Discuss some of the basic requirements for life e.g. food, shelter, clothing. Contrast these "basics" with some of the luxuries of life. Ask the students to make two lists; their "Needs" and their "Wants". Have them compare their lists with others. Ask them if their "favorite" food is a real requirement for life.
2. Have students design a shield using a food they feel is necessary to life.
3. Areas of the shield may include:
   What is the original form of that food?
   How was this food harvested?
   How has this food been processed?
   How was it packaged for the market?
4. Questions for discussion or consideration:
   Discuss the energy resources needed at each step of processing. (Is it energy-intensive?)
   Discuss the possible loss or gain of nutritional value in the course of processing. (To do this, identify which nutrients the food is high in. Are these nutrients heat-resistant? See pages 265 and 267.)
   What was added to the original food?
   What is the energy "cost" of preparing the food?
   Was the energy cost of the packaging reasonable or was this cost greater than the energy cost of the original product?
   What are the nutrients to be gained from eating the food?

BIBLIOGRAPHY AND RESOURCES:

File "Toast"
Anne Pierotti, et al. Energy and Food.
Cooperative Extension Service. Energy: Facts and Figures.
USDA Nutritive Values of American Foods

TEACHER'S COMMENTS:

4th grade - So many students didn't know what the original source of their food was.
4th grade - We spent about 2 hours on this one - two different days. The vocabulary words - harvesting-processing-packaging were difficult for some of my fourth graders. (Although I have a smart, motivated class.) Idea: How about taking one item from any given day from school lunches and duplicating shield. Then students could go over all areas as a group first before doing their own. Cheers! It was worthwhile.
5th grade - We did do a follow up lesson by tracing what part of the country our breakfast food came from.

ACTIVITY TITLE: The Voyage of a Cocoa Bean; From Poverty to Plenty

CONCEPT: To what extent do our food habits affect the lifestyles of others?

SUBJECT AREA: Social Studies, Economics, Home Economics

GRADE LEVEL: 4 - 6

OBJECTIVES:

1) To trace a commodity (food) from its place of origin.

2) To find out what kind of energy is used to produce the final product.

3) To learn that one's own food preferences relate to the production of cash crops.

4) To begin to understand some of the economic relationships (specific to food) between countries.

QUOTE:

"Working conditions: The working conditions are characterized by long hours in humid heat with few breaks. Some jobs require heavy physical exertion. For instance, the two men who load the bananas on the trucks lift and load an average of ten tons of bananas per day. The men who spray the trees with pesticides carry a 30-40 kilo tank on their backs through the fields. They have no masks or protective clothing.
From: The Banana Industry in the Phillipines, McCallie & Lappé.

ACTIVITY:

1. In groups of three or four students, research in the library such foods as: chocolate (cocoa), pineapple, bananas. Each group must have as a part of its report:
   a. A world map showing the principle producers of the food. Show possible shipping routes to the U.S. from the countries on the map.
   b. A botanical description of the plant plus details of its cultivation.
   c. Time line showing the history of its local use and the commercial development as a commodity. Include the name and brief history of the present importing company.
   d. A step-by-step drawing or model of the process the food goes through if it is used as an ingredient (e.g. cocoa bean to hot chocolate).
   e. A graph showing the imports to the U.S. for at least the last 3 years.
   f. A list or pictures of what food staples are eaten in the countries where the food is grown.
   g. Pictures of the people who live in the country where the food is grown, and, people who work with the food.
2. Have each group display its results either on a bulletin board or a display counter.
3. Have the students write a story describing the activities of the people in the country and what food they might like to see grown if they lived in that location.
4. See also Activity "How Far Did Your Breakfast Travel?" page 148

BIBLIOGRAPHY AND RESOURCES:

E. McCallie & F. M. Lappé, The Banana Industry in the Philippines.

ACTIVITY TITLE: Food and the Lifeboat Ethic

CONCEPT: To what extent do we have responsibility for others? To what extent do our food habits determine the lifestyle of others?

SUBJECT AREA: Social Studies, English

GRADE LEVEL: 7-9

OBJECTIVE: To have students feel the pressures and responsibilities of those countries possessing resources by role-playing a situation where they are requested to help countries which do not have the resources. To feel what it is like to be denied help.

ACTIVITY:

1. Assign students to collect visual examples of starvation and deprivation. Put the examples on the walls. Create an audio-visual mood appropriate to the experience, e.g. the lifeboat theory includes pictures of over-indulgence.

2. Considering your own resources, design a space in the classroom that is somewhat inaccessible to the larger number of students, probably in front of the class. Have two or three students enter the "confortable space" and sit detached from the larger group.

3. The "have nots" should be arranged in a crowded and uncomfortable fashion around the "lifeboat." Their mobility is limited so that they cannot get into the "boat."

4. The "haves" possess food resources that must be divided with anyone who "bargains" their way into the lifeboat. The "have nots" may, in return for access, give something. At some point the lifeboat space and resources will be reduced to where the "haves" are approaching a "have not" status.

5. Discuss the implications of using other countries' resources, as well as sharing your own.

6. Questions you may wish to consider: 1) Do the "haves" sell the right to come aboard or will they accept credit? 2) Is this a valid analogy to the world population and food crisis? If not, improve upon it. 3) Does the U.S. have a policy now concerning the needs of countries poor in resources? 4) What could happen if the "haves" changed their food production and consumption habits?

BIBLIOGRAPHY & RESOURCES:

G.T. Miller , Replenish the Earth: A Primer in in Human Ecology

Film, "Let Them Eat Grass"

TEACHER COMMENTS:

Grade 10, English. My class held a debate considering the following issue: Resolved: The U.S. is a lifeboat in a sea of overpopulation and starvation. The life-sustaining resources of this lifeboat are limited and should be used only for the preservation of those already on board. Use this topic also: Resolved: The U.S. has a moral responsibility to provide food aid to the hungry nations of the world.

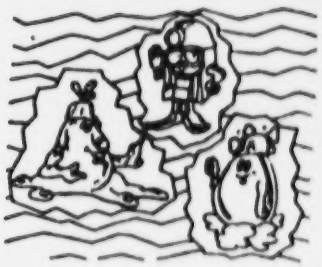
QUOTE:

"...you do get this nasty lifeboat theory--save the splendid people which is us, and let the rest go hang. But there isn't any ocean. Everyone is in the boat, there's the fallacy."

Barbara Ward, economist, author,
U.N. Habitat Conference, 1976.

Grade 10, cont. - Resolved: The developed nations of the world must stop taking the natural resources of the developing nations and thereby stop undermining the carrying capacity of Third World countries

ENERGY SOURCE



ENERGY SOURCE ENERGY EDUCATION PROGRAM

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SOURCE: Energy Source, Energy Education Program
5505 E. Casron St.
Suite 250
Lakewood, CA 90713

Grade Level: (5) (6) (7) (8) 9

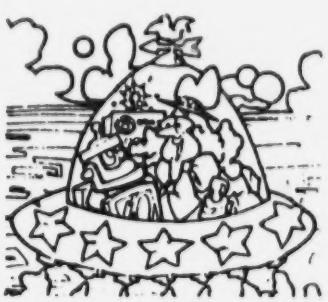
Cost: $25.00 Teacher's Pack (AV Items & Guide)
$50.00 35 Student Pack

DESCRIPTION/CRITIQUE

Energy Source produces three multi-media units for the middle/junior high school: Power Switch (grades 5-6), Energy Crunch (grades 7-8), and Energy in American History (grades 7-8).

Power Switch identifies sources of energy in the past, present, and future. Energy Crunch introduces basic energy concepts and the problems of supply and demand, which help cause the crunch. It analyzes conservation strategies as well as present and future energy sources. Energy in American History traces the use of energy in the United States through the series of energy transitions that have taken place in the country. During each stage attention is paid to how people used energy in their lives, as well as how energy was used in commercial and industrial applications.

Each unit is designed to complete in two to three weeks. Lessons can be completed in a class period. The unit could be used in a social studies, home economics, and/or industrial arts course. The pre- and post- tests are useful for evaluation, and the enrichment activities in the teacher's guide help clarify energy concepts.



MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	
Spirit Masters	
Transparency Masters	
Equipment	X
A/V	X

SUBJECT EMPHASIS

Science	X
Social Studies	X
Home Economics	
Industrial Arts	
Interdisciplinary	
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	
Discipline Focus	
Interdisciplinary	
Muitidisciplinary	
Infusion	

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	
Investigations	
Games	
Simulations	
Group Discussion	X
Debates	
Demonstrations	X
Questions	X

TIME FRAME

Single Class	
Multi Class	
Units	X
Independent Study	

Chapter 2

The Energy Crunch: Problems of Supply and Demand

Some of our energy sources are *renewable*. They can keep on providing energy almost forever. Three of the primary energy sources — solar, geothermal, and tidal energy — are renewable. We expect the sun, the earth's inner heat, and the ocean's tides to be available for millions of years. Secondary sources from these primary sources, such as wind and water, are also renewable.

The other primary energy sources — fossil fuels and nuclear energy — are *nonrenewable*. There is only so much oil, natural gas, coal, and uranium in the earth. As these fuels are used up, they are not replaced. We do not know how much of these fuels remain in the earth or how long the supply will last. But we do know that they cannot last forever.

Energy Supply

Presently, the United States depends on fossil fuels, a nonrenewable energy source, for more than 90 percent of its energy. In 1981, oil provided 43 percent of the energy we used, natural gas 27 percent, and coal 21 percent. (See Figure 2.1.)

We depend on crude oil and natural gas for nearly three-fourths of our energy needs. Until recent years we had enough low-priced oil and gas to meet our energy needs. But our demand for energy grew. Now, much of the oil and natural gas in the United States is difficult to find and take out of the ground. If we continue to depend so heavily on these two fuels, we must expect to pay higher and higher prices as they become scarcer. At some point in the future, it is possible that not enough will be available at any price. Coal, our most abundant fossil fuel, is expected to be used more during the next several decades. But coal, too, is nonrenewable and could eventually become scarce.

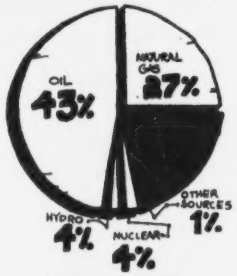


Fig. 2.1 United States Fuel Mix

Since the 1950's, the United States has been importing large amounts of crude oil from other countries. By the late 1970's, we imported about half of the oil we used each year. Lately, the amount of oil we use and the amount that we import have been decreasing. However, our dependence on imported oil still causes political and economic problems for our country.

Oil-exporting countries have a political advantage over us because we depend so much on the oil they sell us. The exporting countries can raise prices or stop selling oil to us at any time — as they did in 1973 and again in 1979. Economic problems can occur if we spend large amounts of money for imported oil, without earning an equal amount from the sale of our products to other countries. A nation, just like a person, cannot continually spend more money than it earns.

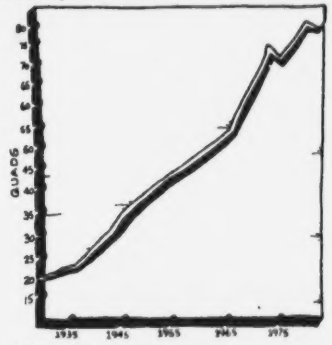


Fig. 2.2 U.S. Energy Consumption

Energy Demands

Throughout our country's history, we have demanded — and used — more and more energy. Today the United States uses almost one-third of the world's energy — more than any other country. From 1935 through 1975, our energy use doubled about every 20 years. (See Figure 2.2) If this were to continue, we would need twice as much energy in the year 2000 as we needed in 1980. Fortunately, our rate of energy growth is beginning to slow down. We do not expect to need twice as much energy in 20 years as we use now. But we will probably need *more* energy than now because of increases in population and energy-using appliances. How much more is not certain.

Where does all of our energy go? As you can see in Figure 2.3, each part of our society — industrial, transportation, residential, and commercial — demands energy. The industrial sector uses the most energy, about 40 percent. This energy is used (1) to produce steel and other metals from raw materials, (2) to manufacture products, (3) to produce and package food, (4) to heat industrial buildings, and (5) to produce electricity.

The transportation sector is the next highest user of energy, using about 25 percent of the energy produced each year to power cars, trucks, planes, trains, and other vehicles.

The residential sector uses about 20 percent of our total energy for space heating, cooking, lighting, air conditioning, running appliances, and other jobs.

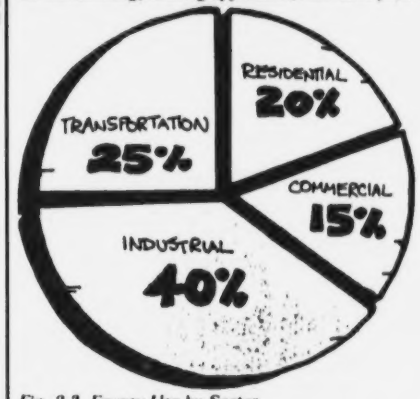


Fig. 2.3 Energy Use by Sector

The remaining 15 percent is used by the commercial sector. Offices, stores, motels, schools, and other commercial buildings use energy in many of the same ways as the residential sector.

Solving the Crunch

To solve the energy crunch, we must slow down our energy demand and increase our energy supply. We can use less energy by practicing energy conservation, which is discussed in the next chapter. With new energy sources, we can become less dependent on expensive, nonrenewable fossil fuels. Some people wonder why we don't switch to renewable sources like solar, geothermal, and wind right away. The problem is that switching from fossil fuels to other sources takes time and money.

So far, no new source will give us the large supplies of energy we need without costing more than the fossil fuels we already use. For example, homes and water can be heated by solar collectors. But solar equipment is costly to install and is unable to supply all the energy a family may need. Their electricity, for example, may come from a power plant that runs on fossil fuels. Someday solar power plants may provide much of our electricity, but it will take years of costly research and development.

At the present, no single energy source is ready to take the place of oil or natural gas. But there are many energy sources that may become important in the future. Together, these energy sources could make us less dependent on oil and natural gas.

Summary

Our demand for energy gets larger while our known supply of fossil fuels, our major energy source, gets smaller. Oil, coal, and natural gas supply more than 90 percent of our energy. But these fuels are nonrenewable, and oil and natural gas are becoming more difficult and expensive to get. We know how to use some of our renewable energy sources, such as heating homes and pools with solar energy, but we aren't yet able to use most of them as easily and cheaply as we use fossil fuels.

To meet the increasing demand for energy by all sectors of society — industrial, transportation, residential, and commercial — the United States has been importing oil. But depending upon imported fuel can and has caused political and economic problems for the United States. To solve the energy crunch, we need to keep our demand from growing so fast and develop other energy sources to increase our supply.

Chapter 2

Energy Exercise

A. Choose the letter of the *best* answer for each item.

1. About _____ percent of the energy we consume each year comes from fossil fuels.
   a. 50 c. 25
   b. 90 d. 75

2. _____ is the most abundant fossil fuel in the United States
   a. Coal c. Uranium
   b. Oil d. Natural gas

3. The _____ sector is the highest user of energy.
   a. transportation c. industrial
   b. residential d. commercial

4. In 1970, we used about _____ as much energy as we did in 1950.
   a. one-half c. 3 times
   b. twice d. 5 times

B. Decide whether each statement is true (T) or false (F).

1. T F Fossil fuels are a renewable energy source.
2. T F Oil supplies about half of our energy needs.
3. T F We import a lot of the oil we use each year.
4. T F Our demand for energy has decreased every year.
5. T F We use nonrenewable energy sources to supply most of our energy.
6. T F Importing oil and natural gas causes political and economic problems.

C. Match the energy source with the percent of energy it provides.

1. ___ Oil a. 27%
2. ___ Coal b. 21%
3. ___ Natural Gas c. 9%
4. ___ Hydro, Nuclear, and Other Energy Sources d. 43%

D. Match the sector with the percent of energy it uses.

1. ___ Commercial a. 25%
2. ___ Industrial b. 15%
3. ___ Residential c. 20%
4. ___ Transportation d. 40%

E. Complete the chart by deciding whether each energy source is primary or secondary, renewable or nonrenewable.

Energy Source	Primary or Secondary	Renewable or Nonrenewable
Fossil fuels	Primary	Nonrenewable
Geothermal		
Wind		
Electricity		
Sun		

Lesson 4: Student Book, Chapter 2 — The Energy Crunch

Materials

- Student books

Vocabulary

- nonrenewable energy source
- renewable energy source

Procedures

A. Discuss Chapter 2

- Use the following questions as a basis for discussing Chapter 2, "The Energy Crunch: Problems of Supply and Demand."

  Why has our demand for energy been increasing?

  (As population increases, there are more people using energy. And as people strive for a higher standard of living and use more work-saving devices, each person uses more energy.)

  Why do we depend on nonrenewable energy sources?

  (We use fossil fuels — a nonrenewable source — because right now they are easier to obtain, more efficient, and less expensive than renewable energy sources.)

  What's the problem with importing more than half of the oil we consume?

  (The countries from which we import the oil can and do raise prices or stop shipments at any time. This causes political and economic problems.)

B. Correct and discuss energy exercise

- Use the following answer key to correct and discuss the Chapter 2 energy exercise.

Chapter 2 Energy Exercise Answer Key

Part A
1. b 2. a 3. c 4. b

Part B
1. False (Fossil fuels are a nonrenewable energy source.)
2. True
3. True
4. False (Until recently, our demand for energy has doubled every 20 years.)
5. True
6. True

Part C

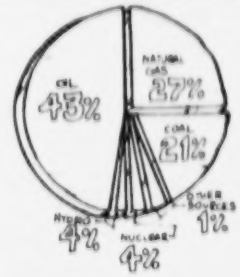
d. 43%	1. Oil
b. 21%	2. Coal
a. 27%	3. Natural Gas
c. 9%	4. Other Sources

Part D

b. 15%	1. Commercial
d. 40%	2. Industrial
c. 20%	3. Residential
a. 25%	4. Transportation

Part E

Energy Source	Primary or Secondary	Renewable or Nonrenewable
Fossil fuels	Primary	Nonrenewable
Geothermal	Primary	Renewable
Wind	Secondary	Renewable
Electricity	Secondary	Renewable
Sun	Primary	Renewable



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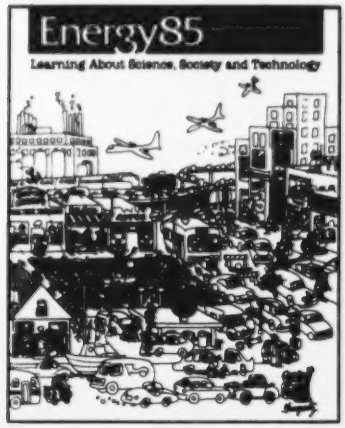
ENERGY 80



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1320A Santa Monica Mall, Suite 205
Santa Monica, CA 90401

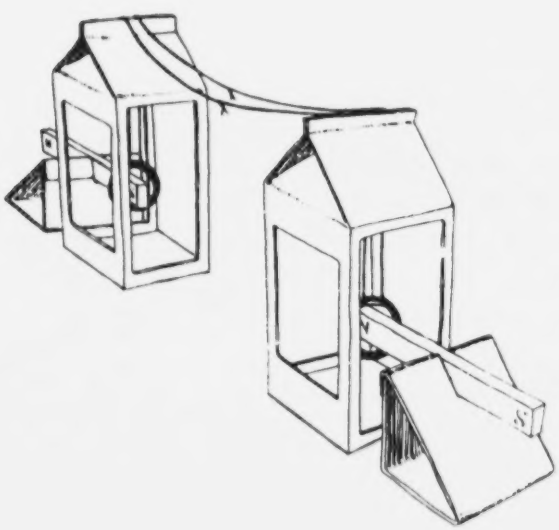
Grade Level: 5 6 (7) (8) (9)

Cost: Free
Subject to available statewide sponsorship

DESCRIPTION/CRITIQUE

Energy 80's packet of material includes a 3 volume resource book, student booklets, and a teacher's guide. Each two page spread in the student booklet addresses a major topic and several subtopics. Volumes II and III contain lessons, activities and reproducible worksheets, activity sheets, readings and transparencies, which support the subtopics. Many of these activities are such that they can easily be infused into existing curricula or combined to create your own energy program.

The material is well designed and organized, provides good background information so that little teacher background is necessary in most cases. The goals are clearly defined as are the objectives for each lesson. Time required for individual activities varies. This material is generally available through inservice workshops.



MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	X
Spirit Masters	X
Transparency Masters	X
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	
Home Economics	
Industrial Arts	
Interdisciplinary	X
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	
Discipline Focus	
Interdisciplinary	X
Multidisciplinary	X
Infusion	

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	
Investigations	X
Games	
Simulations	
Group Discussion	X
Debates	
Demonstrations	X
Questions	X

TIME FRAME

Single Class	
Multi Class	
Units	X
Independent Study	X

Oil & Gas Production & Consumption USA 1859-1981

In 1850, artificial light was expensive. Most people used lamps that burned turpentine, alcohol, lard oil, oil made by heating coal, or, best of all, clean-burning whale oil. Unfortunately, a gallon of whale oil cost two days' wages.

In some places in the earth, an oily substance seeps to the surface of creeks and pools. Some manufacturers who made lamp oil by distilling coal tried distilling this "rock oil." It made a fine lamp oil, but skimming it off creeks was too difficult.

Brine well drillers tried a different way of getting the "petroleum." In 1859, in Pennsylvania, they struck oil at 69½ feet. Drilling for oil was the cheapest way the world had ever found of getting a concentrated energy source.

Crude oil is a complex mixture of many different substances. Refiners separated them by distilling the oil. The useful part, kerosene, was sold for lamps. The useless parts, like gasoline, were mostly thrown away.

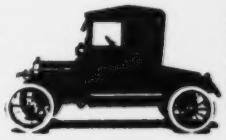
Courtesy Drake Well Museum

Oil production boomed. People from China to Peru wanted kerosene for their lamps. American oilmen sold it to them. America became the leader in oil production, refining, and shipping know-how, a role we still have.

Times changed. Electric lights were invented. The horse began to be replaced. Horseless carriages needed a powerful fuel that could be burned in a lightweight engine. Gasoline was tried and it worked. Henry Ford's cheap Model T put America on wheels.

Now people wanted more gasoline, less kerosene, from the crude oil. Refiners asked chemists to find ways of remaking the crude oil molecules into the molecules people wanted to buy. The chemists did, and went on to invent ways of making new substances from petroleum. In the 1930s appeared synthetic rubbers like neoprene, synthetic fibers like nylon, and plastics like polystyrene. The refinery became a more and more complicated chemical factory.

Where oil was found, natural gas was also, but it was harder to get gas to market. Mile by mile, pipelines were built from the oil fields to the nation's homes and factories. Clean-burning natural gas began to replace coal.



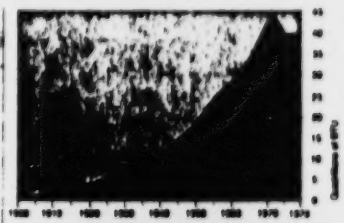
The two maps below show principal natural gas pipeline systems in the United States for 1935 and 1978

In the years after World War I, and again after World War II, we seemed to be running out of oil. Prices rose. Drilling increased. Huge new fields were found in Texas, and shortages disappeared.

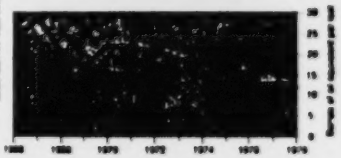
By 1947, the U.S. was using so much petroleum that it was buying more from other countries than it was selling to them. In 1971, for the first time, the year's production of oil in the U.S. was less than it was the year before. In 1979 we imported 44% of the oil we consumed. Prices rose.

Since mid-1979, the number of drilling rigs at work has gone up 50%. But so far, no big new fields have been found. Reserves — the oil we know is there but haven't pumped out yet — continue to decline.

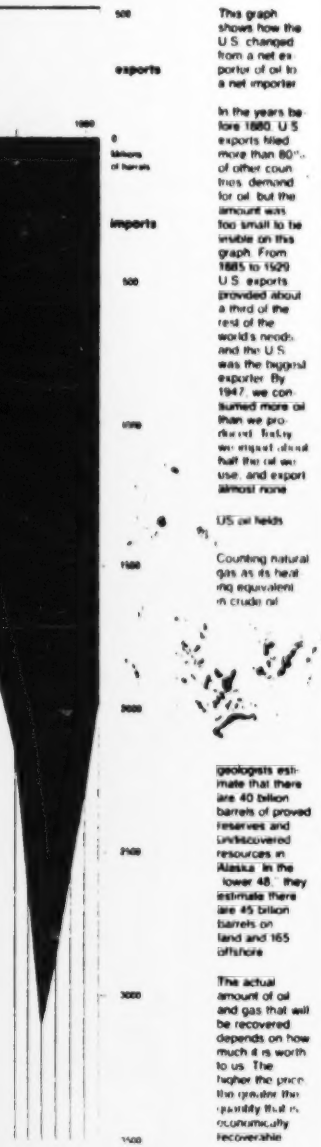
Our country is one of the first to have its oil production peak, because our oil fields were among the first to be discovered, and among the fastest developed. Most of the easy oil is gone. Billions of barrels remain to be recovered, but many will be expensive to get. They will come from hostile environments, like the arctic coast of Alaska or the floor of the sea, and from enhanced recovery techniques like blowing hot steam and detergents down old wells to recover more of the oil.



This graph shows the rise and 'peaking out' of oil and gas production in the 50 states, from 1860 to 1978.



This graph shows how many barrels of oil (or their equivalent in gas) were discovered for each foot of exploratory drilling.



This graph shows how the U.S. changed from a net exporter of oil to a net importer.

In the years before 1880, U.S. exports filled more than 80% of other countries' demand for oil, but the amount was too small to be visible on this graph. From 1885 to 1929 U.S. exports provided about a third of the rest of the world's needs, and the U.S. was the biggest exporter. By 1947, we consumed more oil than we produced. Today we import about half the oil we use, and export almost none.

US oil fields

Counting natural gas as its heating equivalent in crude oil

geologists estimate that there are 40 billion barrels of proved reserves and undiscovered resources in Alaska. In the lower 48, they estimate there are 45 billion barrels on land and 165 offshore.

The actual amount of oil and gas that will be recovered depends on how much it is worth to us. The higher the price, the greater the quantity that is economically recoverable.

Mini-Quiz

1. When oil was first obtained by drilling wells, what was the most important use for the oil?
2. What historical development changed gasoline from a useless by-product to a highly sought after product?
3. What is the name of the factory that converts crude oil to gasoline and other petroleum products?
4. In what decade did the United States begin to consume more oil than it produced?
5. In what decade did domestic production of petroleum decline for a number of years?
6. What country was the largest exporter of oil in the early years of petroleum production?
7. Recently, the amount of oil we import each year began to decline. In what year did we import the most oil?
8. What do we call special ways of getting more oil out of old wells that have stopped producing?
9. Besides being burned as fuel, petroleum is used to make lubricants. Petroleum is also made into a material from which many objects are manufactured. What is that material called?
10. Give two reasons why we can't be absolutely certain how much oil will ultimately be pumped out of the ground.

True or False?

1. Most oil estimated to be still in the ground in the United States is offshore.
2. The more people are willing to pay for oil, the more barrels of oil we will get out of the ground.
3. The American oil industry began in Pennsylvania.
4. There is no more oil to be discovered in the United States.
5. There have been times in the past when Americans believed they were running out of an energy resource.
6. Hardly anyone bothers to look for oil in the United States today.
7. By the time of the Civil War, the oil industry was the biggest business in America.
8. By 1900, long distance natural gas transmission pipelines reached most of the United States.
9. The invention of the electric light had an effect on what refineries did with the crude oil they received.
10. Until Drake's well was drilled in 1859, no one had ever seen crude oil.

Oil and Gas Production and Consumption

Days Required ■ ■ □ □ □ □ □ □ □ □ □ □ ■

For this sequence, your students will need:
Energy 83 pages 16 and 17.
TaE reading 3-25.

Student Learning Outcomes

- Students define "depletable."
- Students identify oil and gas as depletable resources.
- Students identify the United States as one country in which oil production has probably peaked.
- Students relate the price of oil products to the cost of oil production, and recognize that the production costs rise as the most readily available sources are depleted.
- Students describe the rate at which United States oil imports have changed in recent years.

Suggested Teaching Strategy

Our use of petroleum has changed greatly in the last 100 years. Students can see this by reading pages 16 and 17 in **Energy 83**. Read these pages and discuss the history of oil use. Why do people need artificial light? What are some of the ways that have been found to get artificial light? Why would people who lived 200 years ago have wanted to drill wells for brine? What do we mostly use petroleum for today? How do we get the oil we use?

Extension
One of the chief causes of the increased use of petroleum was the rise of the internal combustion engine, which required a powerful, volatile, liquid fuel. **TaE** 3-25 provides a reading illustrating the advantages early inventors of motor cars saw in gasoline.

The United States was once an oil exporter but now imports a great deal of the oil it uses. Study the graph of oil imports and exports on pages 16 and 17. What color on the graph indicates oil exported from the United States? What color represents imported oil? What did people use oil for in 1880? Why did we become oil exporters then? When did the United States begin to buy more oil than it sold? In what year did the country import the most oil? What might account for the decline in imported oil in the last three years?

We still have considerable oil reserves. The map of U.S. oil fields on page 17 and the text just below the map suggest that we have a great deal of oil. Studying the

map and reading the short account of U.S. reserves may make some of your students wonder why we are importing oil. Take this opportunity to discuss the conditions of our reserves and to point out the economic factors. We can indeed still recover U.S. oil if the cost of reaching this oil is comparable to the cost of importing oil.

Our oil production has probably peaked. Look at the two graphs at the bottom of page 17. One shows the oil production levels in the United States. The graph indicates a flattening of oil production in recent years. The second graph deals with productivity and shows the declining ratio of oil produced to feet of well drilled. Ask your students to discuss the significance of the data in the two graphs. What does the combination of lower production and of more drilling mean in terms of the cost of oil and its availability to the consumer?

TaE lesson 3-45 describes a simulation activity to be done by a whole class. It requires an entire period, but is popular with students and demonstrates effectively why it is usually the case that the more of something we extract the more difficult further extraction becomes.

Notes

Answers

1. As kerosene for lamps
2. The invention of the internal combustion engine and the spread of the automobile
3. Refinery
4. The 1940s
5. The 1970s
6. The United States
7. 1977
8. Secondary recovery, enhanced recovery, or tertiary recovery
9. Plastic
10. a) We can't know for certain how much petroleum is in the ground.
    b) We don't know how much people will be willing to pay for it, and that determines how much we can spend getting it out.

True or False?

1. False
2. False
3. True
4. False
5. True
6. False
7. False
8. False
9. True
10. False

Depletion of Finite Resources

We were introduced to this activity in a workshop by Janis Philbin, formerly Program Assistant to the Energy, Food, and You Project, Washington State Office of Public Instruction.

Objectives

This lesson contributes to students' understanding of the following concepts:

As more of a resource is extracted, it becomes more difficult to extract what remains.

Technological innovation can change the availability of a resource.

Extraction of a resource often inflicts environmental damage, energy is needed for the process of re-creating a livable environment.

The resource that is most plentiful is not necessarily the easiest to get.

Format of the Lesson

(Before class, preparation of beads and cornmeal)

Divide class into teams

Scatter beads

Explain rules

Play several rounds

Discuss activity

Discuss meaning of results

Materials Needed

chalkboard

beads four colors, about two tablespoons each. These are the beads used by Boy Scouts in making Indian beadwork; they can be purchased at hobby stores for about 60¢ a color for a tube full. Reusable, though some will be lost each year. If you have no carpeting in your school, you can use short grain white rice dyed with undiluted food coloring and dried in the oven on a cookie sheet. The danger is that, if they become moist, they will leave batik patterns on anything they come in contact with.

cornmeal half a cup.

paper cups five.

OR

macaroni, rice, etc various shapes of macaroni (vermicelli, elbows, stars, spirals, shells, etc) or grains like rice and barley can be substituted for the beads. The larger items are especially appropriate if the activity is done out-of-doors in a grassy field. Since they are biodegradable, leftovers do not need to be picked up provided the field isn't used for contact sports. If desired, they can be dyed with food coloring.

dropcloth (optional) a plastic dropcloth such as painters can save a great deal of cleaning up. A 10' by 25' reusable dropcloth costs about $5.50. It beats sweeping.

Preparing the Beads

Before class, in a cup or other open container, make a mixture of differing quantities of four colors of beads plus one-half cup of cornmeal. The larger the class, the more beads you will need. An all-colors total of 200 beads per student is about right. For example, you could put in three tablespoons of blue beads, a tablespoon of red, five tablespoons of cornmeal, and so on. Set aside out of sight.

Setting Up the Activity

Ask the students to count off by fives, thus forming five teams scattered all over the room.

Appoint team leaders who are good at addition and give each leader a paper cup.

On the chalkboard, make a list of colors and assign each team a color (make one team cornmeal), and note the name of the leader. This will later form the left-hand side of the diagram shown below.

Take the cup of beads and fling the bead mixture out into the room, toward the ceiling (hang on to the cup)!

This act never fails to get the students' attention.

Explaining the Rules

Tell the class they are going to play a game, and these are the rules:

1. "When I say 'Go,' you have exactly one minute to pick up beads of your color — or grains of cornmeal. Stop immediately when I say 'Stop'."

2. "After I say 'Stop,' count how many beads you have picked up. Then give the beads to your team leader and tell her or him how many you had."

3. "Team leaders, add up your team's total score. Tell me what it is and I will enter it on the chalkboard. Leave the picked-up beads and cornmeal in this cup on my desk."

Playing

Say "Go!" Begin timing. Stop the scavenging after one minute.

When students have finished counting, enter the results on the chalkboard. Label the column "first minute" and rule a second column next to it. Label that column "second minute."

Tell the class we will do it again to see what changes.

Continue for as many rounds as are appropriate for the number of beads you tossed out, the difficulty of finding them, and the interest of the students. The final chart may look something like this.

	First Minute	Second Minute	Third Minute	Fourth Minute	Fifth Minute	?
1. red						
2. blue						
3. white						
4. green						
5. cornmeal						

Discussing the Activity: A Sequence of Questions

Predict how many beads we would get if we did another minute's search.

Which took more effort to find, the first bead you picked up or the last bead? Why? (ANS: Last.)

Do you think we would ever find all the beads? (ANS: Maybe not. The last ones will be very time-consuming to find.)

In most classes, more beads are collected in the second minute than in the first, since by then students have figured out where most of the beads went and have become more adept at picking them up. If this happened in your class, ask why the numbers in the second column are bigger than those in the first.

There was far more cornmeal than anything else. Why didn't we pick up more of it than anything else? (ANS: Too hard to pick up compared to beads.)

Can you think of anything we might do to get more cornmeal? (ANS: Get a vacuum cleaner.)

Discussing the Implications: Comparison with Extraction of Resources

In what ways are the beads like the earth's supply of petroleum, copper, or coal?

Would you expect it to require more effort to get the first million tons of coal or the "last" million? (ANS: Probably the "last" million, but it takes extra effort when you are just learning how to extract a resource.) Which costs more to get, the second million tons or the next-to-the-last million tons? (ANS: Clearly the next-to-last million tons.) Will we ever get all the coal or oil? Why not? (ANS: Because it would be so difficult to do, and hence so expensive, that it wouldn't be worth doing.)

Can new technologies change the relative importance of sources? How does the cornmeal resemble a very diffuse though plentiful energy source, like sunlight? How does it resemble tertiary recovery?

In what ways isn't this exercise really like extracting minerals? Was there a changing incentive to get the beads? Is there in extracting minerals? What is it? (ANS: Rising prices.)

Lastly, ask the students to look around the room. Has our "extracting minerals" wrought environmental havoc? Can we put it back to rights? Does it take energy to do so?

Have the students straighten out the room, thus demonstrating that reclamation does indeed require energy, and providing a natural ending for the lesson.

IOWA DEVELOPED ENERGY ACTIVITY SAMPLER

IOWA DEPARTMENT OF PUBLIC INSTRUCTION/ IOWA ENERGY POLICY COUNCIL

1980 Rev., No Copyright

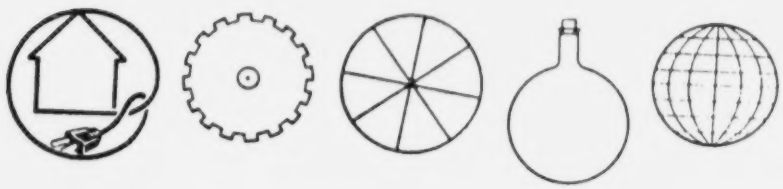
SOURCE: Iowa Department of Public Instruction Information & Publications
Grimes State Office Building
Des Moines, Iowa 50319

Grade Level: 5 6 (7) (8) (9)

Cost: $36.00 set
$ 6.00/ individual volume

DESCRIPTION/CRITIQUE

These are six guides that suggest energy related activities for a specific discipline: math, science, social studies, language arts, home economics, and industrial arts. Each instructor guide is divided into 4 parts: introduction to energy education including general objectives for both teacher and student; list of activities; teacher information includes background information, glossary and bibliography; student activities. Each guide includes a key to subject and grade level as well as type of activity: background information, teacher directed, or student centered. The topics covered are energy use, physical properties, lifestyle and conservation. There are many value-choice type activities. Assumed energy background varies with activity. Some activities are presented in detail and others briefly. Although each guide has a discipline focus, many of the activities are multi-disciplinary. These activities can best be used by incorporating them into existing courses of study. Well planned, worth having.



MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	
Spirit Masters	X
Transparency Masters	
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	X
Home Economics	X
Industrial Arts	X
Interdisciplinary	
Other (lg. arts/math)	X

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	X
Interdisciplinary	
Multidisciplinary	
Infusion	X

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	X
Case Studies	X
Investigations	X
Games	X
Simulations	X
Group Discussion	X
Debates	X
Demonstrations	X
Questions	X

TIME FRAME

Single Class	X
Multi Class	
Units	
Independent Study	

Some Energetic Figuring

Agriculture is a prime user of energy. However, its products, food and fiber, are also energy resources. To measure efficiency of the system in energy terms, the "net" production, one would have to know both input and output levels in terms of calories, joules, BTU's, or kilowatt hours. Such statistics have not been part of traditional record keeping, but are being compiled now that their importance is recognized. The Iowa Crop and Livestock Reporting Service compiled data on energy use on Iowa farms that is included in the 1975 Iowa Farm Fuel and Equipment Survey. The figures cited below come from that publication.

1.

Complete this chart by making the necessary calculations.

Direct Fuel Use on Iowa Farms
1975

Type of Fuel	Millions of Gallons Used	% of Total
gasoline	375	_____
L.P. gas	212	_____
diesel	149	_____
fuel oil	54	_____
Total:	_____	_____

2.

Twenty-three percent (23%) of the gasoline used on farms, 47% of the L.P. gas, 2% of the diesel fuel, and 93% of the fuel oil was used for personal transportation and/or home heating. The balance of fuels mentioned above were consumed in agribusiness. Figure how many gallons of fuel were used for farm production in Iowa in 1975.

a. First calculate the number of gallons of fuels listed consumed for "personal" use. Use the chart provided.

b. Then subtract the amount calculated for personal use (in "a") from the total (in problem 1) to determine the amount consumed for agricultural business.

Type of Fuel	Millions of Gallons Used: Total (Problem 1)	Millions of Gallons for Personal Use ("a")	Millions of Gallons for Agribusiness ("b")
gasoline	_____	_____	_____
L.P. gas	_____	_____	_____
diesel	_____	_____	_____
fuel oil	_____	_____	_____
Total:	_____	_____	_____

3.

Electric usage on Iowa farms totaled 2,223 million kilowatt hours in 1975. Over half of this amount (52% was for general farm use and nearly one quarter (23%) for livestock production. Smaller amounts were used for crop production (8%), home heating (7%), and dairy production (6%).

a. How many kilowatt-hours were used in agricultural practices in 1975 in Iowa?

b. How many kilowatt-hours were unaccounted for?

c. Another way to express energy per unit of time is in joules. One kilowatt-hour is equivalent to 3.6×10^6 Joules. How many joules of electric power were used for agriculture in Iowa in 1975? (Use answer 3a.)

d. Since an energy source with an original output of about 3.1 joules is required to produce each joule of electricity, how much energy was put into the generating system in order to produce this much electricity? (Use answer 3c).

e. A barrel of oil has a typical energy content of 5.8×10^9 joules. What is the "oil equivalent" consumption necessary to yield the energy total you calculated in 3d?

4.

There are approximately 42 U.S. gallons of oil in a barrel. How many barrels of oil were consumed directly for production on Iowa farms? Use data from Problem 2.

5.

Total the "oil equivalent" energy sums from problem 3e, and 4. How does this compare with the country wide figure of 340 million barrels of oil used in food production?

$$\frac{\text{Iowa's use}}{\text{U.S. use}} \times 100 = \% \text{ of U.S. food production energy consumed in Iowa}$$

6.

Authorities estimate that U.S. farms used the equivalent of 340 million barrels of oil for food production in 1976. This is 2.5% of the total annual U.S. energy budget. Calculate the number of barrels of oil on which these figures are based. (Clue: 340,000,000 is 2.5% of ?)

Teacher's Guide to Some Energetic Figuring

Objectives:

Familiarize students with some basic energy accounting, energy units, and using powers of 10.

Recommended additional activities:

See Agriculture, Energy, and Society prepared by NSTA for U.S. DOE, 1978.

1.

Note that the figures represent millions of gallons.

Direct Fuel Use on Iowa Farms
1975

Type of Fuel	Millions of Gallons Used	% of Total
gasoline	375	47
L.P. gas	212	27
diesel	149	19
fuel oil	54	7
	Total: 790×10^6	100%

2.

Type of Fuel	Millions of Gallons Used: Total (Problem 1)	Millions of Gallons for Personal Use ("a")	Millions of Gallons for Agribusiness ("b")
gasoline	375	86	289
L.P. gas	212	100	112
diesel	149	3	146
fuel oil	54	50	4
Totals:	790×10^6	239×10^6	551×10^6

**Total direct fuel use on Iowa farms in 1975 was actually a little higher than these figures show. Some farms (about 4%) used natural gas for home heating and a few used coal or wood.*

3.

a. Agricultural use is 52% + 23% + 8% + 6% or 89%. 89% x 2,223 million kwh = $1{,}978.47 \times 10^6$ kwh. (For convenience, you may wish to "round off" to 1,978 or even 1,980.)

b. 89% ag use + 7% for home heating = 96% accounted for; 4% "unlisted." 4% x 2,223 million = 88.92 or 89×10^6 kwh unaccounted for.

c. $3.6 \times 10^6 \times 1{,}978 \times 10^6 = 7{,}121 \times 10^{12} = 7.1 \times 10^{15}$ joules

d. $7.1 \times 10^{15} \times 3.1 = 22.01 \times 10^{15} = 2.2 \times 10^{16}$ joules

e. $\frac{2.2 \times 10^{16}}{5.8 \times 10^9} = .38 \times 10^7$ bbl.
or
3.8×10^6 bbl.

4.

$$\frac{551 \times 10^6 \text{ gal.}}{42 \text{ gal/bbl.}} = 13.1 \times 10^6 \text{ bbl.}$$

5.

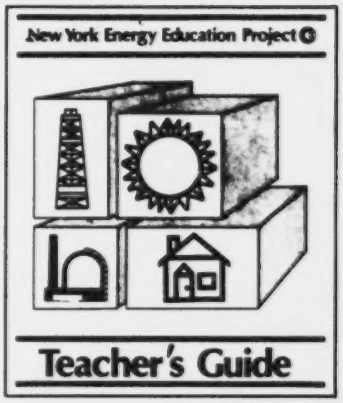
$13.1 \times 10^6 + 3.8 \times 10^6 = 16.9 \times 10^6$ bbl. (Iowa)

$$\frac{16.9 \times 10^6 \text{ bbl. Iowa}}{340 \times 10^6 \text{ bbl. U.S.}} = .0497 \times 100\% = 5\%$$

6.

$340 \times 10^6 \div .025 = 13{,}600 \times 10^6 = 13.6 \times 10^9$ or 13.6 billion bbl.

THE NEW YORK ENERGY EDUCATION PROJECT



STATE UNIVERSITY OF NEW YORK

1984, Copyright

SOURCE: Energy Education Project
SUNY — Albany
1400 Washington Avenue
Box 22100
Albany, NY 12222

Grade Level: 5 (6) (7) (8) (9)

Cost: Activities book - $4.00 each
Teacher's guide - $1.60

DESCRIPTION/CRITIQUE

The activity guides: Energy Conservation and Renewable Energy, contain complete activities with student direction, teacher background, worksheets, and a glossary.* The presentation of the subject is even handed and the activities are interesting. Each guide contains a matrix listing each activity and placing it in its grade level and discipline and/or disciplines is helpful.

Both the teacher and student guide contain suggested approaches for teaching these energy activities, including lengths of units from four days to six weeks. Each activity is formatted to include, objectives, skills and knowledge you need, materials, vocabulary, procedure, questions, review, and ideas for additional research on topic. Though there are some activities that could be infused into an existing course of study, they are best used, as suggested, as units. All the materials provided in this packet are useful additions to the whole, making this a well conceived learning unit. Note: The matrix in the teacher guide under the reading column has the numbers mixed.

*There will be two other guides, Nuclear Energy and Fossil Fuels due to be published by the end of 1984.

60

MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	X
Spirit Masters	X
Transparency Masters	X
Equipment	X
A/V	X

SUBJECT EMPHASIS

Science	
Social Studies	
Home Economics	
Industrial Arts	
Interdisciplinary	X
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	
Interdisciplinary	
Multidisciplinary	
Infusion	X

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	X
Investigations	X
Games	
Simulations	X
Group Discussion	X
Debates	
Demonstrations	X
Questions	

TIME FRAME

Single Class	X
Multi Class	
Units	X
Independent Study	X

4

A Sun Rights Dilemma

The energy crisis has forced us to explore new energy sources. We know that there is not one energy source that will satisfy all the energy needs of the U.S. So people are coming to realize the importance of alternative forms of energy. One energy source that has always been with us, but has been severely under-utilized, is the sun. Today more and more people are interested in harnessing the sun's energy to provide for some of our energy needs. The wind is another form of energy that has been neglected for many years, but is now attracting new interest.

In this activity you will read about a town that has a dilemma. Some residents want to use solar and wind energy for their homes, but because the town is considered a historic site, zoning laws forbid this kind of change. Some citizens want to keep things just the way they are. A third group of residents feel that energy problems can best be solved by stricter conservation methods, without changing the historic look of the town.

As you read the dilemma, consider the need to protect the rights of all citizens: those who wish to develop alternative sources of energy, those who wish to preserve a historic site, and those who favor conservation. Although the town you will read about is imaginary, the problem is a real one which has arisen in many towns and cities across the country.

objectives

At the completion of this activity you should be able to

- o list 5 possible options that the town should consider to solve the problem, and
- o determine the impact of a specific decision.

skills and knowledge you need

Listening, speaking, reading, and writing as a means of communication

An understanding of the Bill of Rights

Clarifying differences in behaviors and ideas

Making decisions and assessing their impact

materials

copies of the dilemma

an overhead transparency

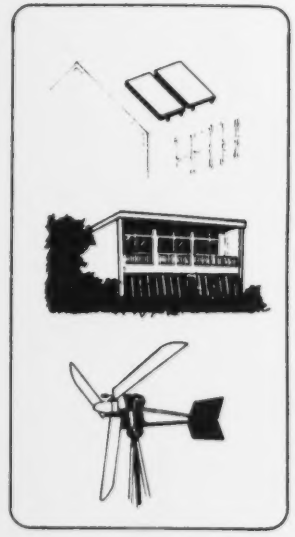
words you'll learn

Active solar collector: a box with a glass cover, specially designed to collect the sun's energy for space or water heating. Air or liquid is circulated through the collector, heated, and then piped to the point of use. Collectors are usually mounted on the south-facing roofs of houses, or on the south side of a house on the ground.

Passive solar: refers to a house or building that is built in such a manner as to capture the maximum amount of sunlight -- which in turn naturally warms the house. Such structures usually have large window areas on the south side.

Wind-powered generator: a modern type of windmill used to generate electricity. It is usually mounted on a tall tower in an open area on the windward side of the house.

Energy conservation: any of the many techniques for saving energy. These include using more insulation in houses, adding storm windows, cutting down on the use of appliances, driving fuel-efficient cars, recycling, etc.



procedure

1. Read and discuss the "Words You'll Learn" section so that you understand the energy vocabulary used in the dilemma.
2. Divide the class into groups of 4 or 5 and have each group choose a leader.
3. Read the dilemma.
4. Discuss the "Pros" and "Cons" of introducing solar energy into the town -- some have been given to you -- and add to the list until you have 7 of each.
5. Discuss the possibility of introducing laws that might protect citizens wishing to use solar energy.
6. Come up with 5 possible solutions to the dilemma.
7. Appoint a recorder and have that person write your five solutions on an overhead transparency and report them to the class.

questions

1. Should Swift and Johnson have the right to install solar collectors and wind machines on their property? Do they already have the right?
2. Does Mr. Jones still have the right to plant his poplar trees, when he knows that eventually they will cast a shadow on Ms. Swift's solar collectors?
3. Where should the responsibility for protecting the users of solar energy lie -- with the town, the state, or the federal government? Why?
4. If a compromise with the historical society could be reached, do you think active or passive use of solar would be more beneficial? Why?
5. Is energy conservation a better solution than using solar and wind energy? How about in the long run? Can they be used together?
6. Is it possible to protect the "sun rights" of people in cities? Why is this a difficult problem?

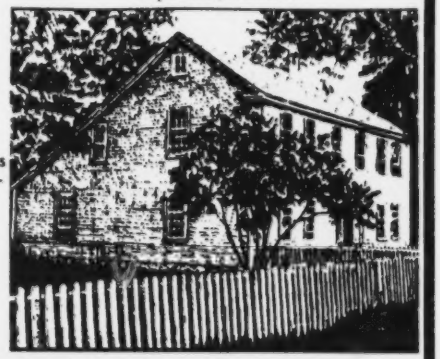
looking back

Coming to understand the energy crisis and how it affects each of us isn't simple. People don't always agree on the solutions, but it is important to understand all possible options and be open to change.

A Sun Rights Dilemma

The year is 1986; the United States' energy crisis has deepened. Gasoline now costs $3.29 per gallon and prospects are that it will hit $4.00 by 1987. The prices of home heating oil and natural gas continue to rise. The energy picture is not bright. Although a number of nuclear plants are still in operation, people have not yet forgotten the incident at Three Mile Island, and few new plants have gone into operation since 1980.

Anytown, U.S.A.



In a small town in the U.S., Anytown, the people are very much aware of the energy crisis that has reached into every home and business across the country. Anytown is a familiar spot to many people. Its history goes back to the 17th century when America was first being settled. The citizens of the town are proud of their heritage and have promoted the town as a historic site. They have preserved the historic character of all the buildings of the town. The town is a tourist attraction and during the summer many families come to enjoy the rich past that is preserved here.

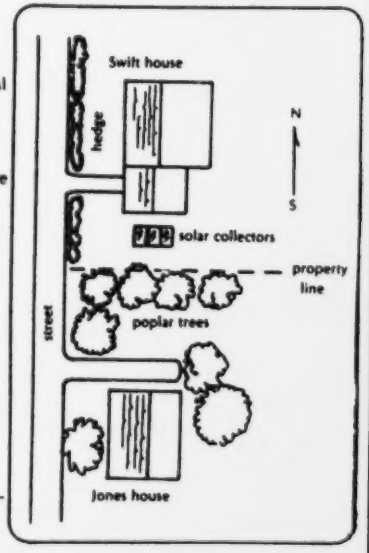
The people of Anytown are conscious that something needs to be done about the energy crisis. Some strongly believe that the way to end U.S. energy dependence on oil (a problem the U.S. has been trying to deal with since 1973) is to enforce stricter conservation methods. Others feel there is a need to develop and emphasize more use of coal and nuclear power. However, another group of citizens in the town has been doing some investigation regarding alternative energy sources -- particularly the use of solar and wind energy. One industrious individual, Ms. Swift, has even gone so far as to construct a small bank of active solar collectors in her yard to show her friends and neighbors how the whole town could benefit from the use of solar energy. At the present time, Ms. Swift uses her active solar collectors to heat the hot water in her home; but she has told her friends that it is also possible to construct a passive solar home which could save thousands of dollars in heating bills.

At the same time, Mr. Johnson is having problems with energy costs at his farm on the edge of town. In order to make himself more energy independent, Johnson intends to install a wind-powered generator on a 30-meter tower to meet most of his energy needs. He plans to contribute any excess to the town electric service. He has applied for a building permit.

Unfortunately, the desire on the part of some of the people to use solar energy has brought about a legal battle within the town. There are a few problems that have to be dealt with and the town council is about to hear the arguments of the people involved. First of all, there exist some strict zoning ordinances in the town regarding what can be built. Since this town is a preserved historic site, laws have been passed that prevent additions to already existing houses or the building of new houses that appear to be out of keeping with the history of

Unfortunately, the desire on the part of some of the people to use solar energy has brought about a legal battle within the town. There are a few problems that have to be dealt with and the town council is about to hear the arguments of the people involved. First of all, there exist some strict zoning ordinances in the town regarding what can be built. Since this town is a preserved historic site, laws have been passed that prevent additions to already existing houses or the building of new houses that appear to be out of keeping with the history of the town. The Anytown Historical Society strongly opposes building passive solar houses or putting solar collectors on the roofs of peoples' houses, as well as the installing of windmills. They maintain that the law forbids such things and plan to see that the law is enforced.

In addition to this, a second set of problems has arisen. After Ms. Swift built her solar collector on her property, Mr. Jones, vice-president of the historical society, who lives next to Ms. Swift, promptly planted five poplar trees, even though the collectors are screened from the street by a hedge. Poplar trees take only a couple of years to grow and provide a great deal of shade. The result is that Ms. Swift's solar collector will soon be useless because of the poplar trees which will shade the collector from the sun. This might force Ms. Swift to abandon her project altogether.



Meanwhile Ms. Fagel, Johnson's neighbor, says that a windmill can make enough noise to bother her on her peaceful farm, as well as interfere with reception on her television. Ms. Fagel is in favor of energy conservation. She says that Johnson could save just as much energy by adding more insulation to his house, and that he should forget about the wind generator. The town is considering denying Johnson's building permit because of her complaints.

The next town meeting will be the arena for discussing the following issues:

1. the historical committee wants stricter enforcement of the zoning laws in the town to prevent the introduction of solar collectors and other innovations to the town. They want present collectors dismantled.

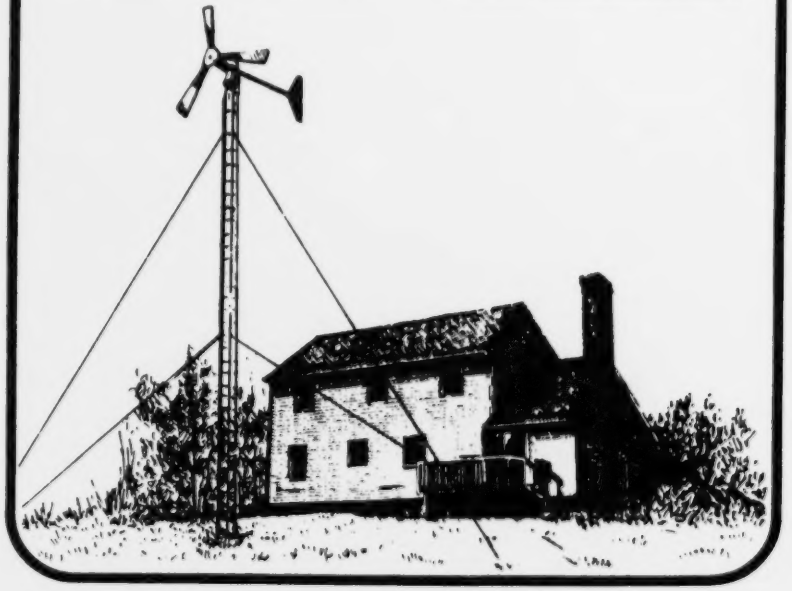
2. Ms. Swift has decided to confront the town with her belief that she has a constitutional right to the sun, and if someone prevents her access to the sun, it is wrong. She wants Mr. Jones to take out the poplar trees which will shade her collector.

3. Mr. Johnson wants to establish just what his rights are as a property holder in his town. Does some group sitting in town office -- elected by him -- have the right to tell him what he can and cannot build on his property?

Now the people in the town are divided into two camps -- those wishing to preserve historic tradition and the financial gain that comes from tourism, and those who wish to introduce solar and wind energy into their homes and change existing laws so that they will be protected. In addition, a third group feels that all the town's energy problems could be solved by more conservation, without needing solar collectors or wind generators.

Now add more Pros and Cons to this list.

Pro-Solar	Anti-Solar
1. will cut down on dependence on oil and electricity	1. disturbs the historic beauty of the town
2. will ultimately be less costly	2. people will stop coming to the town -- will mean a loss of revenue
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____
6. _____	6. _____
7. _____	7. _____



Teacher Information

A Sun Rights Dilemma

Suggested Grade Level and Discipline

Grades 7-9
Social Studies
Language Arts

Skill Objectives

Understanding and applying constitutional rights to solar energy issues

Developing a number of possible options that could be followed to solve the dilemma

Making a decision and assessing its impact

Major Understandings

An alert citizen identifies different positions regarding energy alternatives.

A good decision-maker will analyze and evaluate the positions, weighing the advantages and disadvantages of using solar energy, and will attempt to predict the impact of a specific decision.

Background

We are all acutely aware of the need to conserve energy. More recently Americans are beginning to realize that conservation alone is not the answer to solving our energy crisis. Today we know that alternative energy sources such as solar, wind, or geothermal power do exist as viable energy alternatives. The potential of these sources must be investigated.

In this activity the students are asked to reflect upon two important issues:

1. the value of using solar energy to reduce U.S. dependence on oil;
2. the importance of considering the rights of individuals who wish to experiment with solar energy, and of those who don't.

We must realize that some laws may have to be rewritten in order to protect individuals who wish to solve our energy problems in a more creative manner.

Finally, this activity boils down to having the students negotiate between two values positions: using solar energy to reduce dependence on oil and ultimately save money vs. preserving a historical town that brings in additional funds to the town because it is a tourist attraction.

Advance Planning

Duplicate needed quantities of the dilemma.

Obtain an overhead projector, transparencies, and marking pens.

Suggested Time Allotment

2 class periods

Suggested Approach

Students should be familiar with alternative energy sources; therefore, it is recommended that they do some reading in this area. They might also collect pictures of solar houses and wind generators from magazines. (See References.)

Students should also be familiar with the Bill of Rights in order to apply the concepts to this activity. Briefly review the relevant sections of the Bill of Rights.

Discuss the "Words You'll Learn" with the students.

Divide the class into small groups (4 or 5) and give them each a copy of the dilemma. Have them read the dilemma and then discuss the pros and cons of introducing solar energy into the town. (A partial list is given; they should add to it.)

After each group has had the time to discuss the problems and issues involved, they should come up with a maximum of 5 possible solutions to solve the dilemma.

When the class has completed their brainstorming, a spokesperson from each group could show the solutions on the blackboard or overhead for the entire class to review. The teacher could then lead a discussion to develop the direction the class is moving in. If time permits a simple vote may be taken.

Precautions

Move around from group to group making sure the students are aware of the legal issues involved.

Don't let them get bogged down on any one issue.

Push them to use their creativity when they brainstorm -- brainstorming should be a free, creative exercise.

Encourage the idea of compromising as a means of satisfying the needs of all involved.

Points for Discussion

How do people determine their priorities?

In this case what levels of government might become involved in the issue? Would the problem remain on the local level or might the state or perhaps even the federal government step in to legislate here?

When there is no question of right or wrong, on what basis does a responsible person make decisions?

How absolute should a property owner's right to do whatever he/she likes on his/her property be?

Evaluation

Students could be evaluated on their next test with an essay question in which they must explain how citizens living in a democracy are protected by constitutional rights and yet must abide by the will of the majority.

Modifications

Students could be assigned to represent the two opposing groups in the town and then could debate the issue of introducing solar energy vs. preserving a historic town.

Students could role play the people involved in the dilemma in a simulated town meeting.

References

Beginning Values Clarification: A Guide for the Use of Values Clarification in the Classroom, Sidney Simon and Jay Clark.
(Pennant Press, 8265 Commercial St., No. 14, La Mesa, CA 92041, 1975, $4.95/paper.)

Energy Future: Report of the Energy Project at the Harvard Business School, Robert Stobaugh and Daniel Yergin.
(Ballantine Books, 400 Hahn Rd., Westminster, MD 21157, 1980, $2.95/paper.)

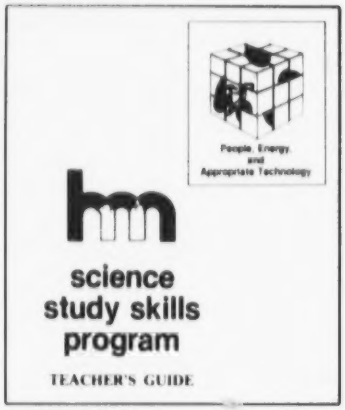
The Energy Policy of the United States, E. Creps.
(National Textbook Co., 8259 Niles Ctr. Rd., Skokie, IL 60077, 1978.)

A Golden Thread: 2500 Years of Solar Architecture and Technology, Ken Butti and John Perlin.
(Van Nostrand Reinhold Co., Lepi Order Processing, 7625 Empire Dr., Florence, KY 41042, 1981, $9.95/paper.)

Solar Access: A Local Responsibility, California Energy Commission.
(California Energy Commission, 1111 Howe Ave., Sacramento, CA 95825, 1978.)

Solar Site Planning: A Guide to Residential Landscaping for Energy Efficiency, David Marlatt et al.
(Southern Solar Energy Center, 61 Perimeter Park, Atlanta, GA 30341, contact SSEC for price.)

PEOPLE, ENERGY, AND APPROPRIATE TECHNOLOGY



NATIONAL SCIENCE TEACHERS ASSOCIATION

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SOURCE: Request "The hm Science Study Skills"
National Science Teachers Association
1742 Connecticut Ave., N.W.
Washington, D.C. 20009

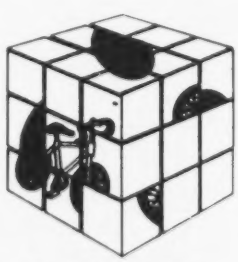
Grade Level: 5 6 (7) (8) (9)

Cost: $ 4.50 Student Text
7.50 Teachers Guide
16.50 Workshop Unit

DESCRIPTION/CRITIQUE

Developed to help students, grades 7-10, learn the necessary study skills to learn science. The fourteen activity oriented units integrate scientific concepts with such skills as graph reading, note taking, science vocabulary, using scientific measuring tools, and test taking. The first eight units help the students establish criteria by which they can judge the appropriateness of a technology (solar greenhouse); and the last section gives the students an opportunity to apply what they've learned.

Most units would take a class period to complete and can be adapted to varying abilities. The student text is both a classroom workbook and a text for energy and appropriate technology. The Teacher's Guide lays out each lesson with directions and necessary preparation. The program is best taught as a complete unit in an ongoing science course.



People, Energy, and Appropriate Technology

MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	
Spirit Masters	
Transparency Masters	
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	
Home Economics	
Industrial Arts	
Interdisciplinary	
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	X
Interdisciplinary	
Multidisciplinary	
Infusion	

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	X
Investigations	X
Games	
Simulations	
Group Discussion	X
Debates	
Demonstrations	
Questions	X

TIME FRAME

Single Class	
Multi Class	
Units	X
Independent Study	

UNIT V: MAKING JUDGMENTS
and
HOW DOES TECHNOLOGY AFFECT THE ENVIRONMENT?

STUDY SKILLS

We often ask students to make comparisons and judgments in science. Comparing and judging are complex processes which need to be broken down into simpler steps for students to master.

This unit presents students with two considerations involved in making judgments or decisions. First, students learn that they need facts in order to make sound decisions and that facts are different from opinions.

Second, students are introduced to the use of criteria to help them judge different sets of facts. They are asked to rate several energy technologies using a given list of criteria.

ENERGY AND THE ENVIRONMENT

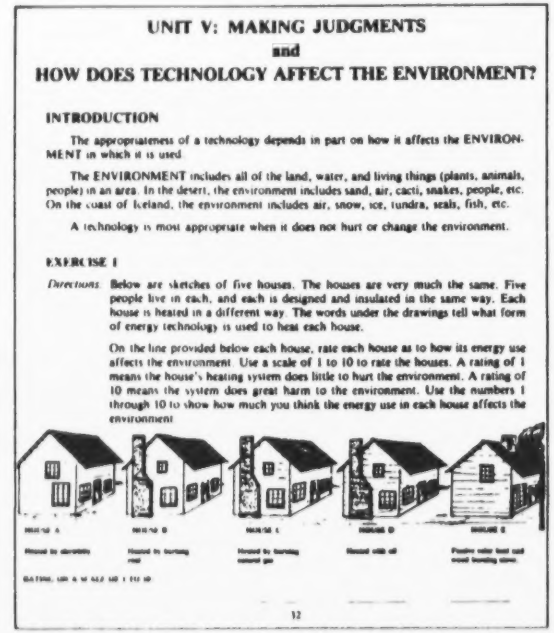
All technologies have some impact on the environment. Appropriate technologies, however, tend to have fewer negative effects on the environment than other technologies. Environmental impact is another factor in evaluating the appropriateness of a technology.

This unit presents students with a set of criteria for judging the effects of five different home heating technologies on the environment. Students are asked to use these criteria to rate different methods of home heating. The criteria given are:

1. The technology should have minimal short and long term effects on living things.
2. The technology should not make the environment look or smell unpleasant.
3. The environment should be able to recover quickly from the impact of the technology.
4. The technology should produce little waste material.

NOTE: The facts provided for students in this unit provide a basis from which students can begin to make judgments about the relative effects of different technologies on the environment. However, the facts are inconclusive. No one yet knows enough about the long term effects of these technologies to make absolute judgments. One of the purposes of this unit is to help your students begin to see how difficult it is to evaluate the long term effects of technologies.

In Exercise I, your students will probably be frustrated by the lack of criteria with which to make an evaluation. Even with the additional information provided for Exercise III, your students may still experience some frustration with the lack of criteria and facts for making a judgment. As you will see on page 43, there are no "right" answers to this problem. When students raise concerns about their frustrations, help them to see the need both for clear criteria and more facts to solve this problem more adequately. Explain that such information is not yet available, and encourage them to continue to seek the information needed to make decisions about these technologies in the future.



UNIT V: MAKING JUDGMENTS
and
HOW DOES TECHNOLOGY AFFECT THE ENVIRONMENT?

INTRODUCTION

The appropriateness of a technology depends in part on how it affects the ENVIRONMENT in which it is used.

The ENVIRONMENT includes all of the land, water, and living things (plants, animals, people) in an area. In the desert, the environment includes sand, air, cacti, snakes, people, etc. On the coast of Iceland, the environment includes air, snow, ice, tundra, seals, fish, etc.

A technology is most appropriate when it does not hurt or change the environment.

EXERCISE I

Directions Below are sketches of five houses. The houses are very much the same. Five people live in each, and each is designed and insulated in the same way. Each house is heated in a different way. The words under the drawings tell what form of energy technology is used to heat each house.

On the line provided below each house, rate each house as to how its energy use affects the environment. Use a scale of 1 to 10 to rate the houses. A rating of 1 means the house's heating system does little to hurt the environment. A rating of 10 means the system does great harm to the environment. Use the numbers 1 through 10 to show how much you think the energy use in each house affects the environment.

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Suggested Directions for Unit V

1. Organize your class into groups of three or four.

2. Ask students to read the "Introduction" (page 32) to themselves. Discuss the concept of environment with students, giving other examples of different environments or asking students for examples.

   Approximate time: 5 minutes

3. Have students read the directions for Exercise I (page 32). Clarify the rating system if it is unclear to students. Emphasize that each of the houses is to be rated individually, not in comparison with other houses.

   Ask students to complete Exercise I in their groups. Because students are not yet given the specific criteria with which to make their judgments at this point in the unit, they may find this exercise frustrating. Do not give students more than 10 minutes to complete Exercise I.

   After 10 minutes, ask one student from each group to report the group's ratings. Ask students on what basis they made their decisions, and what might have helped them make a better judgment about each house.

   15 minutes

MAKING JUDGMENTS: FACT AND OPINION

How did you decide on a rating for each house in Exercise I? Did you have the information you needed to make a good decision?

Making good choices or judgments often depends on having the *facts*. Without facts, you may end up basing your choice on *opinion* only.

A *fact* is something (events, pieces of information, data) which is accepted as true.

An *opinion* is a person's idea or belief. People may have different opinions or interpretations of the same event, data, or experience.

Example: *Fact:* John has brown hair.
Opinion: John's hair is beautiful.
Fact: The sun will set at 7:02 p.m.
Opinion: My view of the sunset is better than yours.

EXERCISE II

Directions: Below are five sentences about strip mining for coal. Each sentence is either a fact or an opinion. In the space provided next to each sentence, write *fact* if you think it is a fact, or *opinion* if you think it is an opinion.

fact 1. Strip mining is the least expensive way to remove coal from the earth.

opinion 2. The least expensive way is always the best for everyone.

fact 3. In strip mining, soil and rock are stripped away so that the coal can be collected.

fact 4. It often takes thousands of years before dry areas that have been strip mined return to their natural condition.

opinion 5. Coal is the most valuable resource in the U.S. today.

MAKING JUDGMENTS: USING CRITERIA

Once you have found the facts which will help you make a judgment, you need a way of comparing them. It is useful to develop CRITERIA or standards against which you can judge your information.

Example: Below are 4 *criteria* useful in judging how different kinds of energy technology affect the environment.

1. The technology should have little immediate or long term effect on living things.
2. The technology should not make the environment smell or look unpleasant.
3. The environment should be able to recover quickly from the technology.
4. The technology should not produce a lot of waste material.

33

4. Have students read "Making Judgments: Fact And Opinion" (page 33) to themselves, or read it aloud. Go over the Example (page 33) with students. Ask students to generate other examples to indicate their understanding of the difference between facts and opinions.

   5-10 minutes

5. Have students read the directions to Exercise II (page 33) and complete the exercise in their groups. Have groups compare their responses. Discuss as necessary.

   5-10 minutes

6. Read "Making Judgments: Using Criteria" (page 33) aloud, or have a student read it aloud. Then, read the four criteria in the Example (page 33), and discuss these as standards by which different technologies can be judged.

   5-10 minutes

EXERCISE III

Directions: Your teacher will give you some facts about each house you rated in Exercise I. Each set of facts includes information about the effects of the energy technology used on the environment.

Read the information about each house. As a group, rate each house again on its effect on the environment. This time, use the facts you have been given and the criteria listed above in making your judgments. Put your ratings below the houses below.

Use the same rating system you used in Exercise I to rate the houses. On a scale of 1 to 10, 1 means a house that does little to damage the environment, and 10 means a house that harms the environment a great deal.

6 7 4 5 5

34

7. Ask students to read the directions to Exercise III (page 34). Distribute the information about the houses, found on the following pages, to the groups. You may want to give each group one copy of the information and ask them to share it. This promotes listening skills and group cooperation. Have extra copies to give to students after the exercise for later reference. Emphasize again that each house should be rated individually, not in comparison with the other houses.

   Note that the information given about House A suggests that electricity could be produced by fossil fuel or nuclear fission. Students should base their judgment about House A on whichever form of production is prevalent in their area.

   When students have completed Exercise III, ask a student from each group to present the group's ratings. Compare group results and discuss similarities and differences. Refer students back to the *facts* in the readings and the *criteria* in the Example on page 33 if they find wide discrepancies in their judgments.

   Ask students if they needed still more information in order to make good judgments. Explain that such information is not yet available, and encourage students to be alert to further information about the effects of energy technologies on the environment.

   20 minutes

NOTE: As explained in the Note on page 40, there are no "right" answers to this exercise. The answers given are suggested, based on the facts available but also on opinions. You may want to use these answers. Or, you may want to evaluate the five houses yourself, and use the rankings which you generate. With either option, what is important is that you help your students understand both the need to evaluate the environmental costs of technologies and the difficulties in doing such evaluation.

HOUSE A

This house has electric resistance heating. It uses approximately 25,000 kilowatt-hours of electricity a year. At the house, it produces no pollution or waste. But electricity must be generated in some way. If coal, oil, and natural gas are used, the pollution and other harmful effects will be similar to those described for Houses B, C, and D.

If nuclear fission is used, there is a small amount of highly radioactive waste produced each year which must be stored away for hundreds or thousands of years. Otherwise, it could cause an increase in diseases such as cancer and leukemia. Permanent ways of getting rid of or storing the waste are being studied, but at present storage is usually at the power plant and considered "temporary."

The power plant (where the electricity is produced) gives off no carbon dioxide, no nitrogen, no particles. However, water used for cooling purposes is often returned to nearby rivers warmer than it was when it was taken out. The change in temperature affects the plants and animals in that part of the river.

HOUSE B

This house has an airtight coal burning furnace. It uses four tons of anthracite coal, which produces two or three times as many particles in the air as the wood used in House E. The coal also produces large quantities of sulfur oxides, which combine with water in the atmosphere to form sulfuric acid. This acid corrodes metal and stone surfaces. When it rains, the sulfur oxides and acids are washed into lakes and streams, increasing the acidity of the water. The effect of this increased acidity is not yet fully understood, but scientists believe it may damage the plant and animal life in these bodies of water. Small amounts of carbon monoxide are also produced by this coal burning furnace.

The mining of this coal, usually by underground methods rather than strip mining, can be dangerous to the miners. It can also lead to underground fires in abandoned mines and cause acid runoff into streams near the mine.

HOUSE C

This house has a gas furnace. It consumes 1,400 hundred cubic feet of natural gas each year, which produces little pollution where it is burned.

The production of natural gas creates several kinds of pollution. It damages vegetation in the environment and makes the air around the production plant unhealthy to breathe.

Natural gas is also highly flammable. Producing and shipping it create the risk of explosion and fire. Gas is shipped as liquified natural gas, and extreme care must be taken as it is unloaded to be sure that no leaks occur.

HOUSE D

This house is heated with oil. It consumes 1,000 gallons each year which produce small amounts of sulfur oxides and carbon dioxide when burned. Offshore drilling of oil and spills from tankers carrying this fuel pose danger to the plant and animal life of the oceans. The danger is not fully understood, but oil is absorbed into the bodies of marine animals and is known to cause cancer. In Arctic regions, an oil spill could blacken ice, causing it to melt more quickly. This could cause widespread climate changes.

HOUSE E

This house has the same amount of window glass as the other houses, but there are no windows on the north side. These windows have been moved to the south side of the house. This house has been positioned so that trees and bushes will not block the south side in the winter. This allows the house to make full use of the sun's energy. Leaves on the trees provide shade in the summer.

This house uses wood burned in an airtight stove to provide back-up heating. Two cords of wood are used during a typical heating season. This amount of wood requires the cutting of several trees and causes pollution in the form of particles of carbon and carbon monoxide. These particles may make the air difficult to breathe. They may also cause cancer. The particles wash out of the air when it rains, darkening snow and tree trunks. The carbon monoxide changes to carbon dioxide fairly quickly. Carbon dioxide contributes to the "greenhouse effect," which will be studied in later units. Many scientists predict that an increase in the carbon dioxide level of the atmosphere will raise the world's temperature and trigger worldwide climate changes.

UNIT V SUMMARY

MAKING JUDGMENTS

To make good decisions or judgments, you need to have *facts* so that your decision is not based on *opinion* alone.

A *fact* is something which is accepted as true. Data you gather in science are facts.

An *opinion* is a person's idea or belief. Once you have facts or data, you can make interpretations or form opinions.

You also need to have *criteria* which serve as standards against which you can judge the facts you gather. Facts give you the information you need. Criteria help you use the facts to make judgments or decisions.

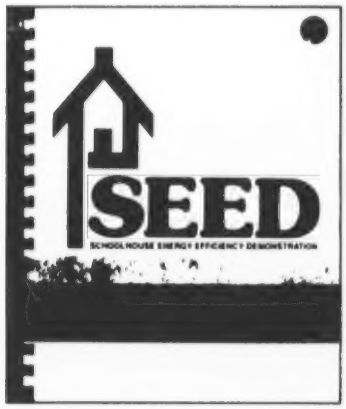
APPROPRIATE TECHNOLOGY AND THE ENVIRONMENT

The *environment* is the land, water, and living things in a particular area. A technology is most appropriate when it does not hurt or change the environment.

Four criteria for judging whether or not a technology is appropriate in its effects on the environment are:

1. The technology has little short or long term effect on living things.
2. The technology does not make the environment smell or look unpleasant.
3. The environment can recover from the technology quickly.
4. The technology does not produce a lot of waste material.

SCHOOLHOUSE ENERGY EFFICIENCY DEMONSTRATION (SEED)



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Houston, TX 77001

Grade Level: 5 6 (7) (8) (9) **Cost:** Free

DESCRIPTION/CRITIQUE

"Something Special From SEED" is a report of 20 demonstration school energy audits conducted (one at Lexington High School) and lists the most effective energy saving recommendations. It contains an energy audit for students and a technical manual for school personnel to conduct audits in their own facility.

"Something Special for Teachers" contains background information on issues; an energy survey to allow students & teachers to examine their own school; and activities that can be infused into existing curricula. The concept of students doing an energy audit is good, but it will require strong teacher direction and advanced 7-9 grade students. The technical information seems accurate and will need to be referred to by both student and teacher. Some of the activities are extraneous to the core project, the audit, but are interesting and can be infused into existing classes.

MATERIALS

Student Activities	X
Teachers Guide	X
Background Reading	X
Spirit Masters	
Transparency Masters	
Equipment	
A/V	

SUBJECT EMPHASIS

Science	X
Social Studies	
Home Economics	X
Industrial Arts	X
Interdisciplinary	
Other	

APPROACH

Content Focus	
Process Focus	
Content/Process Blend	X
Discipline Focus	
Interdisciplinary	
Multidisciplinary	
Infusion	

INSTRUCTIONAL STRATEGIES

Informational Text	X
Stories	
Case Studies	
Investigations	X
Games	
Simulations	
Group Discussion	
Debates	
Demonstrations	
Questions	

TIME FRAME

Single Class	
Multi Class	
Units	X
Independent Study	

II. A Look Inside The School

H. When the students proceed inside, have them record light levels using a light meter, and note temperature levels using a mercury or digital thermometer. (Be sure body heat is not allowed to affect readings.) Light readings are more realistic if made at desk-top level. It is not necessary to visit every area of the building. It is wise to select representative samples of classrooms, rest rooms, etc., and observe other areas from hallways.

I. Be sure students note which lights are unnecessary or too bright. Also look for energy waste where lights are on in unoccupied areas. Discuss how the colors of the walls affect light levels. Students could calculate how much energy would be saved if energy-saving fluorescent tubes (35 watt) were placed throughout the school. If fluorescent lamps have been removed, have students check to see if the ballasts are disconnected. Ask why this is important.

J. Students will be interested in knowing if the light switches are conveniently located and used. Remind students to observe how the natural light is utilized. Does the use of window shades optimize the use of natural light?

K. Ask the students' opinion concerning skylights and if they are wisely used. Are the lights, fixtures, and skylights clean? Discuss how much dirty windows, fixtures and lamps affect natural lighting.

III. Cafeteria/Kitchen

L. When visiting the kitchen area, have the students ask the head cook about pre-heating practices, baking schedules, and the types of energy-using equipment necessary to produce the meals.

IV. Exhaust Fans

Have students count exhaust fans as they tour the building. Check Industrial Arts area, kitchens, rest rooms, auditoriums, etc. Note the size, operating times, and methods of fan control.

V. Hot Water For Washing

Note if water faucets drip or have excessive pressure. Students can consider if water restricters would reduce waste. What hot water temperature is required by the local health code/the Federal government? How is the water heated?

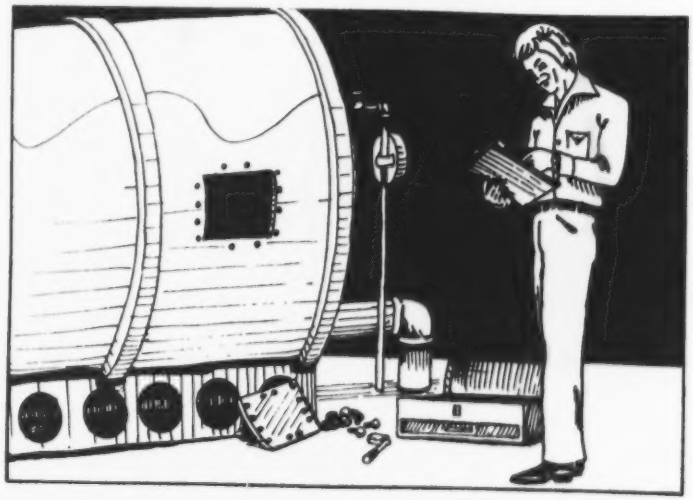
VI. Heating/Cooling System

How does the heating/cooling get to the classroom or hallway? Have students note if the vent or heating element appear clean and unblocked. They will want to know how the return air gets to the heating source and if there is air movement in the area. Have students judge if the thermostats are properly located and controlling the environments. Are these thermostats too easily "adjusted" by unauthorized persons?

VII. Control Room

Visiting the boiler/furnace room and listening to an explanation/demonstration of how systems work can be very informative. Have the custodian demonstrate the role of time clocks, the night set-back system, and the control features that make the heating/cooling unit(s) operate more efficiently. Request that students always be alert for cleanliness. Dirt is an insulator, but not a desirable one.

Student's Name _____ Grade Level _____ Room Number ____
School _____ Number of Students _____
Length of School Day _____ Hours for Cleaning _____
Monthly Heating/Cooling Costs _____



Outside

I. A Look At The School From Outside

A. Draw an outline of the school in the space below.

N
W E
S

School Outline

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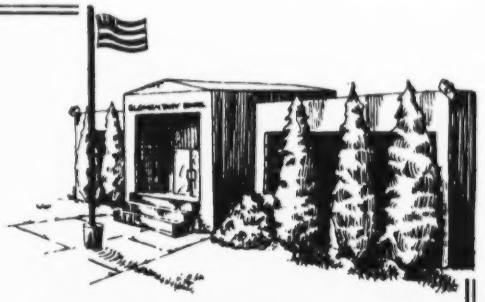

B. What direction does the school entrance face? _____
Which way does the wind usually blow? _____
What protection does the building have? _____

C. Does the school have many windows? Many Some Few
What percent of the wall area is windows? _____ %
How many windows face South? ___ North? ___ East? ___ West? ___
Can the windows be opened? ___ Are the windows tight fitting? _____
Should any windows be double paned? ___ Where? _____

D. Could energy be saved by replacing selected windows with insulated walls or insulating material? _____ Where? _____
Are any window cracked or broken? ___ How many? _____
Do the outside doors fit tightly? _____
Do doors need weather stripping? _____
Should there be double doors at any of the entrances? _____

E. Are the outside walls in good condition? _____
Of what material are the outside walls made? _____
Is there insulation in the walls? _____ Roof? _____
How does the color of the walls or roof affect energy usage? _____

G. Is the security lighting effective in preventing vandalism? _____
How many hours are these outside lights turned on? _____

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Inside

II. A Look Inside The School

H. Note the following for each area listed below:

Area	Color of Walls	Lighting level in Footcandles	Type of Lighting Incandescent	Fluorescent	Other	Temperature
Halls						
Offices						
Classrooms						
Gym						
Cafeteria						
Library						
Other						

How does the color of the walls affect lighting? _____

I. List any areas of the school where there are unnecessary lights: _____

List any rooms where the lights appear too bright: _____

List any areas where lights appear too dim: _____

Does the school use energy-efficient fluorescent lamps? _____

Mercury vapor? _____ Other? _____

If fluorescent lamps have been removed, are the energy using ballasts disconnected? ___

J. Are there areas where lights have been left on when no one was present? _____

List:

Are the light switches located for easy use? _____

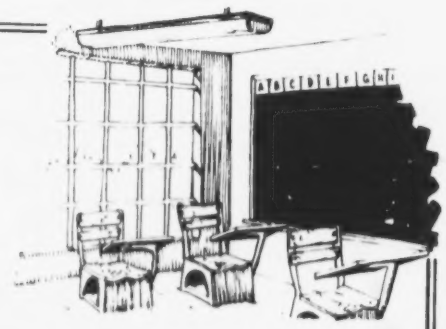
Is the natural light from windows used properly? _____

K. How does keeping the following clean affect energy usage?

Windows _____

Light Fixtures _____

Skylights _____



III. Cafeteria/Kitchen

L. What energy sources are used in the kitchen:

Natural gas _____

Electric _____

Other _____

List kitchen items using energy (not human) and hours they are used:

Item	Hours Used

Is the kitchen well-arranged to use energy efficiently? _____

Is heat producing equipment located next to cooling equipment? _____

IV. Exhaust Fans

Check the hours exhaust fans operate in the following areas:

Rest rooms Kitchen _____ Art _____

Industrial Art Other _____

How are most exhaust fans controlled? _____

OTHER USEFUL INSTRUCTIONAL AND BACKGROUND MATERIALS

CURRICULUM MATERIALS

MATERIALS WITH INTERDISCIPLINARY EMPHASIS

BTU (BETTER THAN USUAL) TEACHER DEVELOPED ENERGY MATERIALS by the Science and Math Teaching Center at Michigan State University. 1980.

Available from: Clearinghouse, Energy Administration, Department of Commerce, P.O. Box 30228, Lansing, MI 48909. Free.

This multi-disciplinary teacher resource, for grades 4-8, comes as a looseleaf packet. Included are simulations, games, demonstrations and investigations.

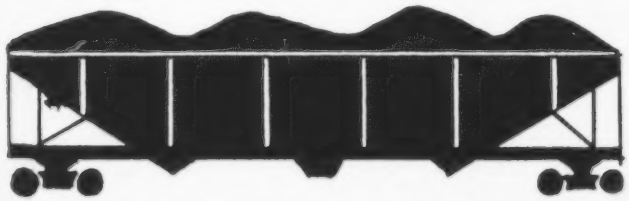
These well planned, teacher developed units can be infused in a variety of disciplines, contain a strong conservation orientation and require no energy background.

ENERGY ACTIVITIES FOR THE CLASSROOM, VOL. II by Herbert L. Coon and M. Alexander. 1978.

Available from: ERIC Clearinghouse for Science, Math & Environmental Education, College of Education, Ohio State University, 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212.

This 148 page book, for grades K-12, emphasizes energy activities for science. It contains activities, divided by grade and subject, that have been arranged around a stated concept. It includes discussions, demonstrations, research, and simple lab experiments.

Collection is uneven, it contains several good ideas. Activities are all suggested by teachers. Could be used as infusion activities for existing programs. Requires support information.



ENERGY AND MAN'S ENVIRONMENT by Energy and Man's Environment Copyright 1982.

Available from: Energy and Man's Environment, 5160 Wiley Post Way, Salt Lake City, Utah 84116

Approximately 100 lesson plans organized to educate students about the energy education goals of EME: sources of energy, uses of energy, conversion of energy from one form to another, impacts of energy development, limited nature of natural resources, future of energy sources, and energy conservation. The collection of core materials (available only through EME Implementation Program) has ideas for science, mathematics, social studies, language arts, and vocational education. Activities range from short, simple ideas to library research.

The strength of EME materials is the quantity of activities that can be easily infused into curriculum. Activities vary greatly in amount of teacher preparation necessary. Materials are best integrated into existing units rather than presented as a special energy unit.

THE ENERGY CHALLENGE by U.S. Dept. of Energy. 1978. Updated 1981.
Available from: U.S. Department of Energy, Office of Education, Business and Labor Affairs, Washington, D.C. 20585. Free.

Six interdisciplinary units for grades 5-8 are structured around 24 ditto masters. They include ideas for research, interviews, role-playing, discussion and problem solving.

Topics include: general energy use, fossil fuels; alternative energy sources, conservation, and energy problems. The teacher guide provides objectives, background information, vocabulary and suggested approaches for each activity. No energy background assumed and the program is best presented with each unit in sequence. Some of the activities may be infused into ongoing curriculum in various disciplines.

ENERGY LEARNING CENTER by Chevron, USA, Inc. Copyright 1980.
Available from: Chevron, USA, Inc., Public Affairs, Youth and Education, P.O. Box 7753, San Francisco, CA 94120. Free.

The materials, for grades 6-8, are designed for science or language arts courses. A teacher and student resource offering a broad overview of energy with informational text, questions, discussion topics, opportunities for investigation, research and letter writing.

An interesting collection of material focusing on the history of energy, energy sources, energy uses, and future projections. There are spirit masters for testing, a teacher guide, glossary, and a list of references. Materials are pro fossil fuels, and assume no energy background.

ENERGY PACKET by Massachusetts Audubon Society. Various years.
Available from: Massachusetts Audubon Society, Public Information Officer, South Great Road, Lincoln, MA 01773. $5.00 plus $1.75 postage and handling.

This material, for grades 6-9, is science-social studies oriented with informational text and simple experiments.

A wealth of information on energy sources, including food energy, energy in nature, fossil fuels and energy alternatives. Packet includes 7 back issues of the Curious Naturalist which focus exclusively on energy. Each magazine provides lucid accounts with many photographs, charts, diagrams and suggested projects. In addition, there are background readings, public service information flyers and bibliographies. Background information for the teacher is included. The materials can be used separately or together for a good overview on energy issues.

MAINE TEACHERS ENERGY PRIMER by Tux Turkel. Copyright 1979.
Available from: Maine Audubon Society, Gilsland Farm, 118 Route 1, Falmouth, ME 04105.

This interdisciplinary booklet for grades 5-7 combines experiments, questions, ideas for discussions, investigations and reading assignments.

Four chapters cover energy basics, use, conservation, and future use. The objectives are clearly stated with a glossary, and other activities included in each chapter. A good introduction to energy that can be used as a unit, mini course, or infused into existing curricula.

TEACHING ENERGY AWARENESS by Patrick D. Gare & John Masoncup. 1980 revision, copyright 1978.

Available from: Center for Teaching International Relations, University of Denver, Colorado 80208. $14.95 plus $2.00 postage.

This book is a teacher resource appropriate for grades 5-12, emphasizing science/social studies activities but also economics and home economics. The materials use the instructional strategies of involvement, discussion, data gathering, using community resources, and questioning.

A good source of teaching activities that compliments an existing course of study while creating an awareness of and interest in energy issues. The activities are interesting, "do-able" and require few extra materials. Almost half of the book is hand-outs and information to support the activities.

SOLAR SPOTS by the Energy Administration at the Michigan Department of Commerce.

Available from: Clearinghouse, Energy Administration, Michigan Dept. of Commerce, P.O. Box 30228, Lansing, MI 48909. Free.

This looseleaf, multidisciplinary material, for grades K-8, is intended as a teacher resource with investigations, games, simulations, and demonstrations.

A series of activities to help teachers infuse the study of solar energy into existing curriculum. Included is an overview, a glossary, and a brief list of solar energy resources. No energy background is required.

MATERIALS WITH SCIENCE EMPHASIS

CATCH A SUNBEAM by Florence Adams. Copyright 1978.
Available from: Harcourt Brace Jovanovich, Children's Books, 1250 Sixth Avenue, San Diego, CA 92101. $10.95.

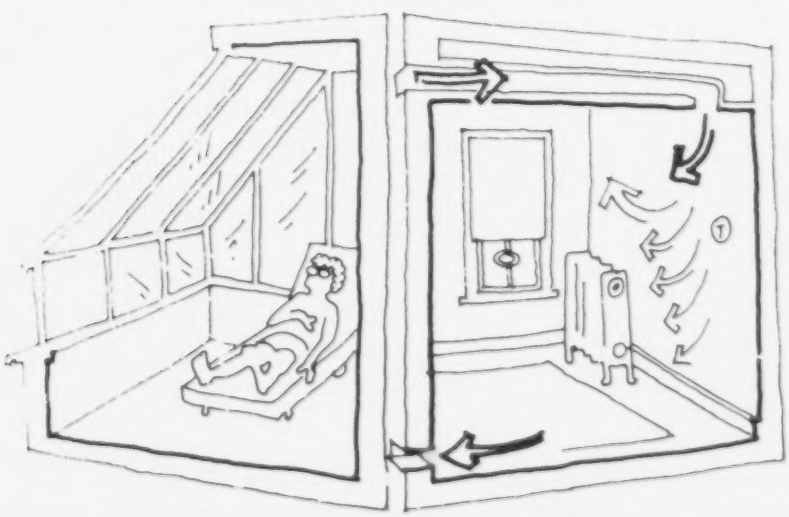
This book for grades 4-7, presents an investigative and demonstrative approach towards solar energy. Useful as a teacher's resource, it offers 16 experiments with a wide range of difficulty.

Science oriented, solar projects. Most require little energy background and use simple, easy to obtain materials. Useful for infusion into an existing unit on energy or solar power.

ELECTRICITY CHOICES. Copyright 1983.
Available from: Innovative Communications, Inc., 2923 N. Main St., Walnut Creek, CA 94596. $39.50.

These booklets, for grades 7-9, are science oriented energy information. Each set consists of five titles (cost includes 8 sets): Fuels That Burn; Wind and Water; Solar Energy; Nuclear Energy; and Power Management.

These teachers' guides include lesson notes and worksheets.



ENERGY: A PHYSICAL SCIENCE by Paul Brandwein, et. al. Copyright 1980.
Available from: Harcourt Brace Jovanovich, Inc., School Department/Eastern Region, Saddlebrook industrial Park, Saddlebrook, NJ 07662.

This is a physical science text book, for grades 7-9.

A year long science program using energy as the organizing principle.

ENERGY ACTIVITIES FOR JUNIOR HIGH SCIENCE by Multiple authors. 1977.
Available from: Cheryl Belford, Energy Specialist, Minnesota Dept. of Energy & Economic Development, 980 American Center Bldg., 150 E. Kellogg Blvd., St. Paul, Minn. 55101. Free.

This material for junior high students, is a packet of six activities ranging from 20 to 30 minutes each for science classes. Activities are designed by teachers, emphasize individual and group participation, sharing, and values clarification.

Assumes little energy background. Each activity includes some background information and student worksheets. Recommended for infusion into existing science curriculum.

A PORTFOLIO OF ENERGY IDEAS by Richard C. Clark. 1981.
Available from: Science Specialist, Minnesota Dept. of Education, Capital Square, 550 Cedar St., St. Paul, Minnesota 55101. Free.

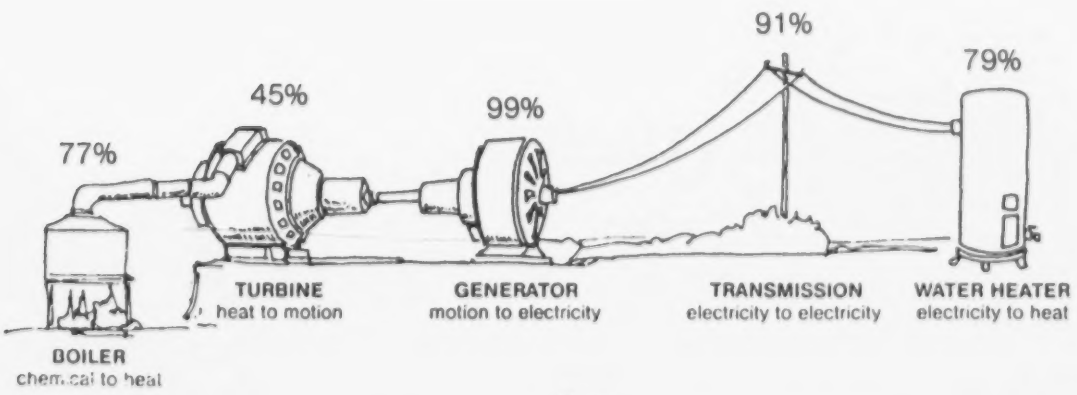
This material for junior/senior high school students consists of 10 activities oriented towards science and using skills involved in creative problem solving. It includes experiments, demonstrations, discussions topics, and informational text.

These interesting and well planned activities require some knowledge about energy and focus on the logic and strategy of problem solving. Topics covered include energy transfer and storage, energy cells, heat loss, and other physical science principles of energy. The units are well planned.

SCIENCE ACTIVITIES IN ENERGY by Oak Ridge Universities. 1977.
Available from: U.S. Dept. of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Free.

This material for grades 5-9, consists of seven file folders, each with 11-16 activity sheets. Some activities have teacher's guide. The time needed for the activities varies but all foster open ended exploration and are designed for infusion into existing science courses. They provide information, investigations, demonstrations and questions.

Well designed, attractively presented packets of activities on various energy topics, Biomass, Conservation I and II, Electric, Chemical, Wind, Energy Storage. Each activity sheet begins with a question and graphically directs the inquiry to its conclusion. Additional ideas are included for further exploration and the experiments require easy to obtain supplies. Assumed energy background varies, however, elementary physical science is needed to explain the "why" of the concepts encountered. Some experiments should be closely supervised. (Note: Solar I & II may be available again but at present are unavailable.)



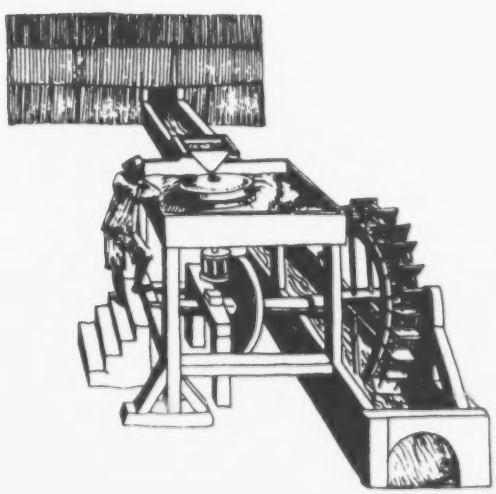
MATERIALS WITH SOCIAL STUDIES EMPHASIS

ENERGY AND AMERICAN HISTORY UNIT II by the Indiana Department of Education. 1983.

Available from: Indiana Dept. of Education, Division of Curriculum, Room 229, State House, Indianapolis, IN 46204. Free.

This looseleaf material for grades 6-9 is designed for social studies courses with applications for science, language arts and practical arts. It contains information, questions, discussion topics, value judgements and games.

A well designed curriculum focusing on energy resources, conservation, and interdependence during our colonial period, industrial revolution and the post World War II period. Designed to allow flexibility for different grade levels, it offers many suggestions for individual, group, school, and home activities. Teacher guide and lesson plans included, and no previous energy background needed.



THE ENERGY FUTURE TODAY by National Science Teachers Association. 1980.

Available from: U.S. Department of Energy, Technical Information Office, P.O. Box 62, Oak Ridge, TN 37830. Free.

This material for grades 7-9, while interdisciplinary in nature, is best suited for social studies classes. A variety of instructional techniques are used including discussion, role playing, decision-making, classification, and inference from written and graphic material.

It contains student material as well as background information, lesson overviews, and learning objectives for the teacher. It introduces basic energy concepts while encouraging active student participation.

MATERIALS FOR OTHER DISCIPLINES

ALTERNATIVE ENERGY SUITE (Music) by Joan Maute. Copyright 1982.
Available from: Studio 2, 6631 Muirwood Ct., Lisle, IL 60532. $17.00.

This material for grades 4-9, uses a musical treatment of wind, sun, hydroelectric power, and conservation to teach energy concepts. It contains a cassette, lyric sheets, and teachers guide with songs, pre/post tests, and activities.

An innovative and interesting approach. The lyrics are catchy, the music is good, and the background information and suggested lessons are interesting. An opportunity for some team teaching. (Tapes previewed were of poor quality.)

EASY ENERGY READER SERIES (Language Arts) by Information Planning Association, Inc. 1980.
Available from: U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Free.

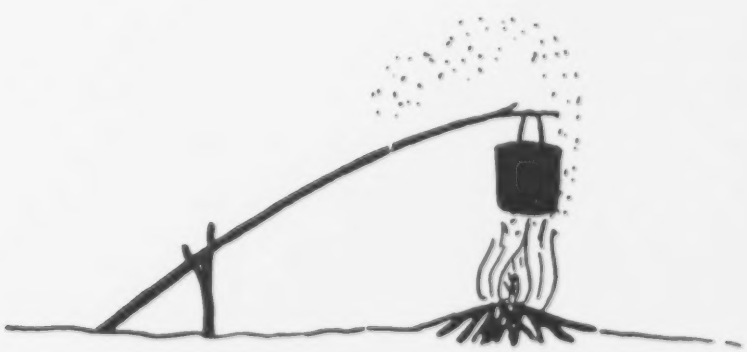
These student oriented, paperback books, designed for grades 6-9, contain informational text for language arts classes. Well illustrated, it does not contain possible questions or activities.

The four volumes: What Is Energy?; History of Energy; Energy, What Can We Do Right Now?; What About the Future?, contain articles from a variety of sources and are intended for slow readers. Contains some dated information and attention should be given to areas dealing with policy, statistics and costs.

ENERGY ACTIVITIES FOR HOME ECONOMICS by Audrey Grate. 1981.
Available from: Home Economics Supervisor, Minnesota State Dept. of Education, Capitol Square, 550 Cedar St., St. Paul, MN 55101. Free.

This looseleaf, teacher resource, for grades 7-12, uses an open ended, problem solving approach, and emphasis is on decision making process. The instructional methods used are discussions, experiments, role playing, menu planning, and sewing projects.

Eleven activities covering conservation, energy use and energy choices. Included is an excellent paper highlighting the developmental needs of the middle school youngster and a rationale for developing home economics curriculum at that level. Resources are suggested for most activities. Experience in home economics required.



ENERGY ACTIVITIES FOR INDUSTRIAL ARTS by D. Thomas Ryerson. 1981.
Available from: Industrial Education Supervisor, Minnesota Dept. of Education, Capitol Square, St. Paul, MN 55101. Free.

This looseleaf material, for grades 7-12, is a hands-on approach with 12 activities involving students in energy related projects, utilizing constructions, comparison tests, and drawings.

These unusual activities focus on different areas of industrial arts: wood, metal, drafting, electronics, etc. Topics covered are: solar collectors; greenhouses; temperature sensing; gasohol; conservation; insulation; recycling; Savonius motors; and pedal power. Resources are listed for some activities. Experience in industrial arts required.

ENERGY, ENVIRONMENTAL AND OUTDOOR EDUCATION ACTIVITIES
by John C. Miller. 1980.
Available from: State of Minnesota, Department of Education, Elementary and Secondary Education, 644 Capital Sq. Bldg, St. Paul, MN 55101. Free.

This multidisciplinary teacher resource is a folder of hands-on activities, investigations, and demonstrations for outdoor education classes.

Material contains suggestions for outdoor activities to help develop 9 energy concepts: solar; energy resources; energy forms; diversity of sources; transfer of energy; energy measurement; conservation; dependence; cooperation. Some background information is given, and student outcomes are stated but some are unrealistic. Some familiarity with recreation activities is necessary.

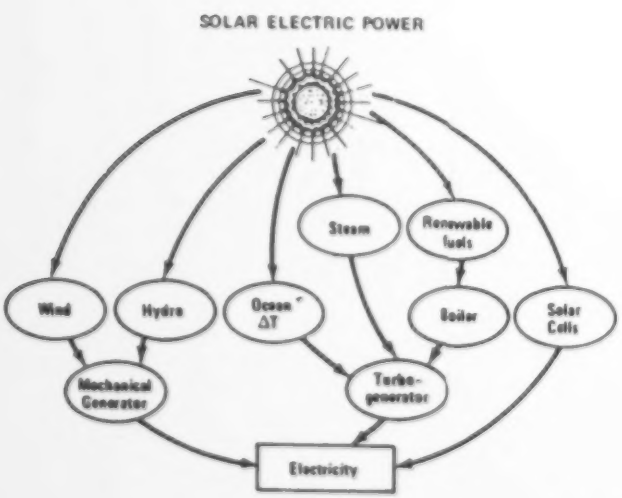
ENERGY HORIZONS (Language Arts) by Christina Miller & Louise Berry.
Copyright 1982, 1984.
Available from: Educators Publishing Service, Inc., 75 Moulton St., Cambridge, MA 02238. $4.00. Teachers Manual $2.00.

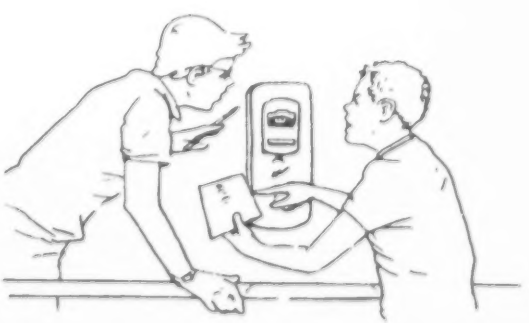
This workbook for grades 5-6 contains both informational text and questions for social studies and language arts classes. There will be 4 workbooks; 2 are currently available.

Book I focuses on energy sources, II on electrical energy. Both look at energy from a historical perspective as well as present day usage and problems.

Reading comprehension exercises, vocabulary and some activities are suggested.

The accompanying teacher guides give background information and additional references. No energy background required.





BACKGROUND INFORMATION

FOR TEACHERS

ENERGY AND EDUCATION: TEACHING ALTERNATIVES by Frederick E. Rosthurnas (Ed). Copyright 1978.
Available from: National Education Assoc., The Academic Bldg, Saw Mill Road, West Haven, Connecticut 06516 $8.95.

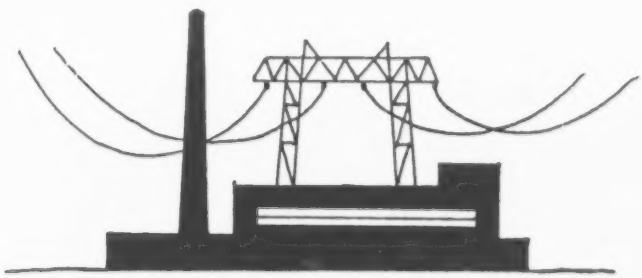
This book is an informational text, including discussions, and research with an emphasis on science and social studies.

It contains some interesting lessons grouped into mini-units. Strength of book is presentation of the need for energy education. However, the text, statistics, references and figures are outdated.

ENERGY-ENVIRONMENT SOURCE BOOK by John M. Fowler. Copyright 1980.
Available from: NSTA, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009. $9.00 plus $2.00 postage and handling.

This book is intended to provide teacher with adult level energy information.

This reference work gives teachers authoritative information on the issues, problems, and the facts of energy. Profusely illustrated with charts and tables which require updating, it includes a glossary and appendices with technical information. A valuable reference source.



ENERGY AND ENVIRONMENT by John Fowler, 2nd Edition, Copyright 1984.
Available from: McGraw-Hill Book Co., 1221 Avenue of the Americas, New York, NY 10020. $22.95.

This is a college text on energy issues and is appropriate for teacher reference and advanced high school students.

This book completely covers the study of energy, from what energy is to the political and social implications of its use.

SUN UP TO SUN DOWN by Shawn Buckley. Copyright 1979.
Available from: McGraw Hill Publishers. $6.95.

This book for grades 7-9 emphasizes industrial arts through informational text and definitive illustrations.

Explains how solar technologies for heating work. A section on solar economics is concise and to the point. Useful only if trying to explain to students how devices work, as it offers analogies that students might understand. May be too advanced for many students.

FOR STUDENTS

THE CHILDREN'S SOLAR ENERGY BOOK (EVEN GROWN-UPS CAN UNDERSTAND) by Tilly Spetgang & Malcolm Wells. Copyright 1982.
Available from: Sterling Publishing Co., Inc., 2 Park Avenue, New York, NY 10016. $12.95.

This hardcover book for grades 4-6, is a humorous approach to what solar energy is all about. Contains informational text and investigations.

A funny book presenting the facts about solar energy. Included are five short activities. Could be used as a supplement to an existing science course.

No energy background required.

ENERGY: NEW SHAPES/NEW CAREERS by Reed Millard. Copyright 1982.
Available from: Julian Messner, 1230 Avenue of Americas, New York, NY 10020.

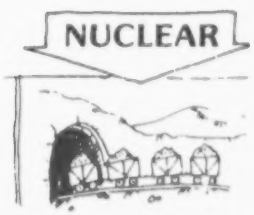
This informational text, for grades 6-8, has an emphasis on science and career education.

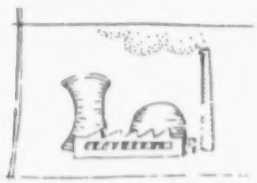
It describes new developments in the field of energy and the challenge of reconciling limited resources with increasing needs. Also discusses various career opportunities in the field of energy, the necessary preparation and future potential.

NUCLEAR POWER: FROM PHYSICS TO POLITICS by Lawrence Pringle. Copyright 1979.
Available from: Macmillan Publishing Co., 866 Third Ave., New York, NY 10022. $7.95.

This book, for grades 6-8, offers an informational text, with emphasis on science and social studies, but, no activities or exercises.

An overview of nuclear power, tracing it from its development and early uses to the present controversy over nuclear power. It addresses the government's controversial role as promoter and regulator; and the political, social, economic, and emotional aspects of the controversy surrounding it. Needs minor updating, but is an exceptional source for background information.





WORLDWATCH PAPERS by Worldwatch Institute.
Available from: Worldwatch Institute, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036. $4.00/copy bulk rate. $25.00 year subscription.

These booklets offer informational text, in a variety of disciplinary areas.

Worldwatch Institute publications cover global economic and environmental concerns. Their "Papers" series range in length from 22 pages to 83 pages and, to date, the 61 titles include 17 directly related to energy. They are an excellent, inexpensive, and accurate source of information. Send for list of publications.

PERIODICALS

Alternative Sources of Energy.

Each issue contains a wide spectrum of practical information concerned with the development of alternative technologies in energy sources, agriculture, architecture, transportation and communication.

Publisher: *Alternate Sources of Energy*
107 S. Central Ave.
Milaca, MN 56353

$25/year - bimonthly

Country Journal.

Many good articles on energy use related to gardening, agriculture, fuels and forests, architecture, transportation, electric power, health, waste disposal and conservation.

Publisher: *Country Journal Publishing Co., Inc.*
P.O. Box 2402
Boulder, CO 80321

$15/year

Energy and Education Newsletter.

A bi-monthly newsletter features editorials by energy professionals, listings of free and inexpensive materials, book reviews, current data on the energy situation, and news from energy educators.

Publisher: *N.S.T.A.*
1742 Connecticut Ave., N.W.
Washington, D.C. 20009

$9/year

Environment.

Food and famine, health and disease, energy and conservation, pollution, waste — facts of our environment — are all given meaningful reporting in this publication.

Publisher: *Heldief Publications*
4000 Albemarle St., N.W.
Washington, D.C. 20016

$20/year

Environmental Action.

Major coverage of environmental quality issues including energy.

Publisher: *Environmental Action*
1346 Connecticut Ave., N.W.
Suite 731
Washington, D.C. 20036

$18/year

Environmental Education Report.

An excellent publication covering all aspects of environmental education. Includes good book and material reviews.

Publisher: *American Society for Environmental Education*
Wheeler Professional Park
P.O. Box 800
Hanover, NH 03755

$25/year

Mother Earth News.

Truly "more than a magazine" as it is advertised. The most information you can find under one cover on alternative energy and lifestyles, ecology, nature, and doing more with less.

Publisher: *The Mother Earth News, Inc.*
P.O. Box 70
Hendersonville, NC 28373

$18/year

National Geographic.

Excellent coverage of energy development is provided in one or two articles each year.

Publisher: *National Geographic Society*
17th and M Streets N.W.
Washington, D.C. 20036

$15/year

New Alchemy Institute.

A subscription membership includes current journal and newsletters. The Institute is concerned with the development of ecologically sound forms of energy, agriculture, aquaculture and housing. A good source for alternative energy information.

Publisher: *The New Alchemy Institute*
237 Hatchville Rd.
East Falmouth, MA 02536

$35/year

Not Man Apart.

Presents excellent articles on people learning to live in their environment. Much earth and energy news, good reading lists and reviews in each issue.

Publisher: *Friends of the Earth Foundation*
1045 Sansome St.
San Francisco, CA 94111

$15/year

Science.

Weekly magazine published by the AAAS, should be checked regularly by teachers. Many bits of information can be obtained from the sections "Research News", "News and Comments", letters and editorials. Many of the articles could be assembled for class readings or research references for advanced students.

Publisher: *American Association for the Advancement of Science*
1515 Massachusetts Ave., N.W.
Washington, D.C. 20005

$50/year

Scientific American.

Monthly periodical covering all aspects of science.

Publisher: *Scientific American*
P.O. Box 5919
New York, NY 10017

$24/year

Science and Children.

Published monthly during school year and covers environmental issues, ecology and energy. Each article ends with a few references, some free; and each issue has a teacher guide.

Publisher: *Curriculum Innovations Inc.*
Western Ave.
Highland Park, IL 60035

$4.75 per student (minimum 15 to one address)

Smithsonian.

This publication has frequent articles on natural resources and energy use providing good commentary on man's technology in nature's environment.

Publisher: *Smithsonian Associates*
P.O. Box 2953
Boulder, CO 80321

$18/year

Yankee.

Articles on New England lifestyles, then and now, environmental impacts, agriculture, conservation, etc., make this a useful reference.

Publisher: *Yankee*
Dublin, NH 03444

$13.50/year

AUDIO-VISUAL MATERIALS

This is a brief list of energy related films, filmstrips and video cassettes. They are recent releases or films worth considering from small distributors and of high quality. A more complete list is available in Movies About Energy listed with the addresses of American Petroleum Institute. The local utility serving your school may have additional offerings. Previewing films before renting is encouraged.

As If People Mattered: E.F. Schumacher

Bitteroot Films. 1979. 16mm color. 16 mins. Grades 7-adult. A summary of Schumacher's economic arguments with special reference to the world energy situation. It emphasizes the need for practical alternatives. Distributed by Bullfrog Films.

Decision: Energy for the Future

Earth Metabolic Design. 1980. 16mm color. 11 mins. Grades 4-adult. This short animated film serves as an overview and introduction to the questions of energy use, alternative energy possibilities, and the history of man's reliance on energy. Distributed by Bullfrog Films.

The Ecology of the Automobile in Modern Society — Its Present and Future

Educational Images. 3 Filmstrips, teaching guide, cassette. Examines the relationship of the automobile to modern Society from a biological approach, assesses its impacts, benefits and costs, and suggests how its role must evolve if it and society are to survive.

No Act of God

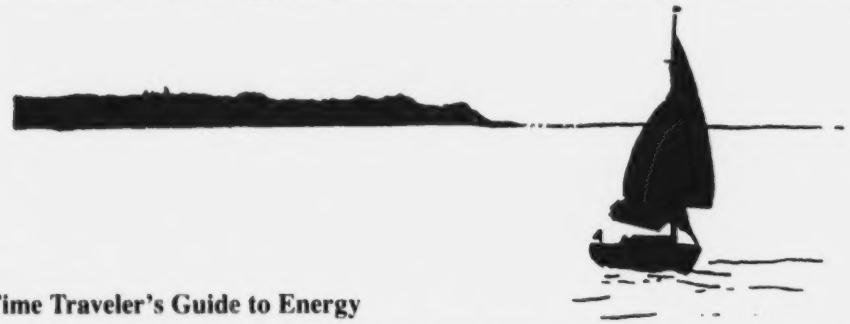
National Film Board of Canada. 16mm color. 28 mins. Grades 7-adult. This film about nuclear power focuses on the central issues: lack of safe waste disposal system, threat of terrorist activity, and the loss of personal freedoms combined with the worldwide proliferation of plutonium for weapons that must characterize a society dependent on nuclear power. Distributed by Bullfrog Films.

Power Without End

Guidance Association. Video cassette. 16 mins. Grades 6-10. The sun, wind, geothermal, water and tides are alternative sources of energy examined in this program, as are methods of conservation.

Switch on the Sun

Guidance Association. Video cassette. 15 mins. Grades 6-10. This production explores ways we can harness solar energy and put it to use as a safe practical alternative to fossil fuels.



Time Traveler's Guide to Energy

Epcot Films, 1983. 16mm color. 26 mins. Grades 5-8. A boy from the future accidentally erases important computer data on the subject of energy in the late 20th century. In a desperate search for the information he needs, he transmits himself into the computer of a girl in the present. Together, they explore the world of energy, surveying resources and technologies of the past, present and potential future. Live action and animation used.

Toast

Earth Chronicles. 16mm. and video cassettes. 12 mins. Grades 3-adult. Starting at the oil-well and ending at the toaster, this film traces the energy intensive process, that is involved in bringing a slice of toast to the table. The accompanying study guide explains the concept of net energy profit. Distributed by Bullfrog Films.

We've Got the Power

American Friends. 140 slides or 2 filmstrips and cassettes. 26 mins. Grades 7 to adult. A discussion-provoking presentation on the choice we must make; whether to rely on nuclear power and fossil fuels or switch to renewable energy sources and practical conservation. Documents some local achievements (Franklin County, Mass.) and shows how people can work together for a safe energy future. Distributed by Bulldog Films.

The World of Energy

I - 1979 and II - 1982. National Geographic filmstrips and cassettes. 14 to 17 mins. Grades 5-12. $79.95.

I - focuses on traditional energy sources; wind water and fossil fuels, energy use, and conservation.

II - looks at energy sources, their use, conservation, and different aspects of our energy problem. Examines nuclear energy, its advantages and disadvantages, and alternative energy sources.

The addresses for the proceeding film distributors and other usually reliable sources of audio-visual aids are listed below. Send for catalogs containing current rental and sale price information and a complete list of materials offered.

Bullfrog Films
Oley, PA 19547

The Center for Humanities
Communications Park
P.O. Box 1000
Mt. Kisco, NY 10549

Disney Films
11 Quine St.
Cranford, NJ 07016-3197

Educational Images
P.O. Box 367
Lyons Fall, NY 13368

Encyclopedia Brittanica
Educational Corp.
425 North Michigan Avenue
Chicago, IL 60611

Eye Gate Media
333 Elston Avenue
Chicago, IL 60618

Guidance Associates
Communications Park
P.O. Box 3000
Mt. Kisco, NY 10549

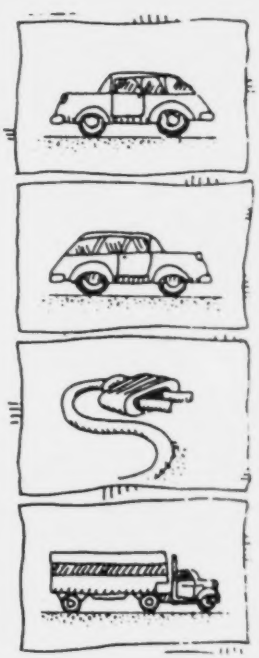
National Geographic Society
Educational Services
Washington, D.C. 20036

National Film Board of Canada
16th Floor
1251 Avenue of the Americas
New York, NY 10020

Nova Scientific Corp.
111 Tucker Street
P.O. Box 500
Burlington, NC 27215

American Petroleum Institute
Public Relations Department
Photographic & Film Services
1220 L St., N.W.
Washington, D.C. 20005

Publishes Movies about Energy, a catalog of more than 1000 energy films.



COMPUTER SOFTWARE

Since 1983, almost every educational school supplier has included a few computer programs in their catalogs. Because both quality and educational value of the programs vary greatly, it is important that you use caution in purchasing them. Before buying, try to find someone who has used the program or preview it yourself, if possible.

The following are two examples of available energy software packages.

Available From:
Alabama Dept. of Economic and Community Affairs
3465 Norman Bridge Road
P.O. Box 2939
Montgomery, Alabama 36105-0939
Attn: Mrs. Donna Robinson

Each of the following include a disk and teacher guide. $20.00 each.

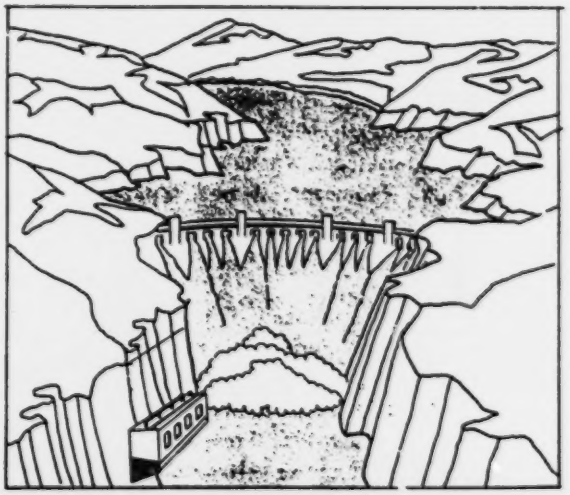
Energy Crossword
Apple II and IIe, grades 7-12. Energy terms used in crossword puzzles. Includes crossword maker which allows teacher/student to input their own puzzles.

Energy Hangman
Apple II and IIe, grades 7-12. Popular word guessing game using energy words and definitions. Includes software to allow teacher to input his or her own set of terms.

55 MPH Sign of the Times
Apple II and IIe, grades 7-9. Tutorial program which illustrates the way laws are passed, using as an example the law bringing about the 55 mile per hour speed limit.

Energy Mathematics
Apple II and IIe, grades 3-7.
- Energy Addition. Drill for one, two and three digit numbers with two levels of difficulty.
- Energy Subtraction. Drill for one, two and three digit numbers with two levels of difficulty.
- Energy Multiplication. Drill for one, two and three digit numbers with two levels of difficulty.
- Drill for one and two digit numbers with two levels of difficulty.

U.S. Energy Use
Apple II and IIe, grades 4-9. Tutorial program on history of energy use and the fuels used in the United States.



Available From:
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, D.C. 20009

Each of the following includes a disk, documentation and a teachers guide.

Electric Bill
Apple II, II+, IIe, TRS-80. Grades 5-12. Shows how electric bills are computed, how to read bills for information on energy use, and how rate structures are constructed and applied. Cost $25.00.

Energy Conversions
Apple II, II+, IIe, TRS-80. Grades 7-12. Can be used to convert one energy unit to another so that trends and fluctuations can be compared. Cost $29.00.

Home Energy Savings
Apple II, II+, IIe, TRS-80. Grades 5-12. A game that teaches students the principles of energy conservation and cost/benefit of decision making. Cost $35.00.

Personal Energy Inventory
Apple II, II+, IIe, TRS-80. Grades 7-12. Teaches students about energy consumption by monitoring their energy use. Cost $39.00.

Power Grid
Apple II, II+, IIe, TRS-80. Grades 7-12. Simulates the operation of an electric utility, with student acting to bring individual plants on line to meet anticipated demand. Cost $59.00.

Note: The educational value of the NSTA Program increases when used with the teacher developed units produced by the Merrimack Education Center. Contact Jean Sanders, Merrimack Education Center, 101 Mill Rd., Chelmsford, MA 01824. (617) 256-3985.

The following are other usually reliable sources of software; send for catalogs.

Berkshire Biological Supply
P.O. Box 404
Florence, MA 01060
(800) 343-4054

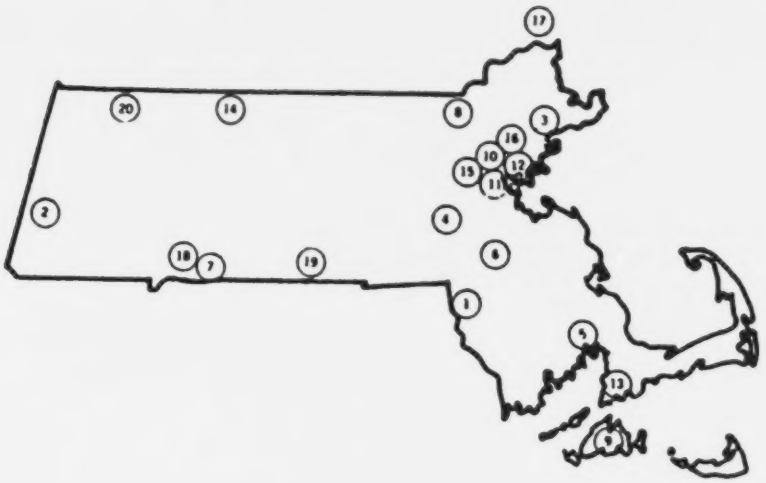
Educational Images, LTD
P.O. Box 3456, West Side Station
Elmira, NY 14905

Hammet's Microcomputer Division
P.O. Box 545
Braintree, MA 02184

McGraw-Hill
1221 Avenue of the Americas
New York, NY 10036

Society for Visual Education Inc.
Dept. B.H.
1345 Diversey Parkway
Chicago, IL 60614

FIELD TRIP SITES



The field trips were carefully chosen with the intent of helping reinforce the energy concepts printed at the beginning of the guide. Each deals with more than one of the concepts and can easily be combined with another field trip. Remember, though not listed, the school building and/or schoolyard is one of the most useful field trips you can plan (and the price is right).

(1) Attleboro Industrial Museum
42 Union St.
Attleboro, MA 02703
(617) 222-0801
Jerry Keen

At present, one of six planned exhibits is complete: a reproduction of a silversmith's shop; tours of the existing displays are possible. No charge. Please contact the museum through your principal.

(2) Berkshire Garden Center
Route 102
Stockbridge, MA 01262
(413) 298-5530
Marcia Mullen (413) 298-3926

Fifteen acre botanic garden, 2 solar greenhouses. The 2 hour program is elementary and middle school level.

(3) Beverly High School
Solar Photovoltaic Visitor Center
Sohier Road
Beverly, MA 01915
(617) 927-4760

Solar photovoltaic cells convert the sunlight directly to energy that supplies about 9% of the electricity for Beverly High School. 30 minutes, free.

(4) Broadmoor Wildlife Sanctuary
Massachusetts Audubon Society
280 Eliot St.
South Natick, MA 01760
(617) 655-2296 or 235-3928
Ellissa Landre

A guided tour of a rustic barn that has been renovated to a solar heated visitor center with composting toilets.

(5) Commonwealth Electric Generating Plant
2421 Cranberry Highway
Wareham, MA 02571
(617) 291-0950 (800) 642-7030
John R. Farnham, Manager of Consumer Relations

A plant tour of the facility in Sandwich, MA, including a multi-media presentation, control room visit, and "Turbine Hall". 1½ hours, free.

(6) **Kendall Whaling Museum**
27 Everett Street
P.O. Box 297
Sharon, MA 02067-0267
(617) 784-5642
Robert Webb, Director of Education

Paintings, ship models (from sailing vessel days to a modern factory whaling ship), scrimshaw, a turn-of-the-century whale boat, films and music. Arrange tour two weeks or more in advance for customized tours. Fee: .50 for children, $1.00 for adults.

(7) **Laughing Brook Education Center and Wildlife Sanctuary**
Massachusetts Audubon Society
789 Main St.
Hampden, MA 01036
(413) 566-8034
Richard Selig

Special energy programs include the solar greenhouse and a composting toilet exhibit.

(8) **Lowell National Historical Park/ Lowell Heritage State Park Visitor Center**
Lowell, MA 01852
(617) 459-1000

Offers a series of 90 minute tours:
- Water Power Tour — illustrating the way large textile mills of the 1800's were powered.
- Suffolk Mill Tour — shows production of cotton textiles and use of water power in a 19th century factory.
- Textiles and Technology — begins with a presentation in the visitor center and then a tour of the historic Turbine Room.

The State Park Headquarters has a new water power exhibit. From June through Columbus Day there is a three hour boat, trolley and walking tour of the canal, gatehouses and related energy sources.

(9) **Martha's Vineyard Wind Farm Museum**
R.F.D. 2
Box 86
Vineyardhaven, MA 02568
(617) 693-3658
Peter & Gerry Tailer

Tour begins with an introduction to energy use, past and present, including food as energy. An historic exhibit of energy sources: hand pumps, water pumps, Persian windmill, Archimedes screw, wind power, passive solar, open trestle, photovoltaic, etc. Open June to October 31. Group rates, 1 hour.

(10) **Minuteman Tech Energy House**
Minuteman Regional Vocational Technical School
Marrett Road
Lexington, MA
(617) 861-6500
Dennis Kane

A tour of a super energy-efficient house, work done by students. Can be combined with an economics tour of McDonald's run by students.

(11) **Museum of Science**
Science Park
Boston, MA 02114
(617) 723-2500 ext. 350

Thomson Theater features daily programs on electrical power, and there are ongoing energy exhibits including a working model of a solar house. Visits are free to Massachusetts schools with advance reservation.

(12) **Mystic Station**
173 Alford Street
Everett, MA
Mailing Address: Charlestown, MA 02129
(617) 424-2459 or 424-3748

Multi-media presentation, compares fossil fired generation with other ways of generating electricity. Tour of plant, classroom materials are available. Tuesday, Wednesday, Thursday, 1½ hours, free.

(13) New Alchemy Institute
237 Hatchville Road
East Falmouth, MA 02536
(617) 563-2655
Denise Bachus

The institute was founded to develop, test, and teach ecological approaches for meeting basic human needs: food, energy, and shelter. The 12 acre farm is open year round and includes 3 free standing solar greenhouses, organic gardens, and a super-insulated auditorium. Specialized workshops can be arranged. Fee.

(14) Northfield Mountain
Recreation and Environmental Center
RR 63, Box 377
Northfield, MA 01360
(413) 659-3714

Pumped storage hydroelectric plant. Tour of upper reservoir and powerhouse, April 1 — October 31. Free. Under 12 not allowed on powerhouse tour. Nature and hiking trails.

(15) The Old Schwamb Mill
17 Mill Lane
Arlington, MA 02174
(617) 643-0554
Patricia C. Fitzmaurice, Director

Originally built as a water-powered grist and sawmill around 1650; converted to steam in the 1880's (vestiges of waterpower system visible). Working 19th century woodworking machinery. 10-4 weekdays; flexible on days and hours for school groups. Tour takes 1¼ hours; longer if special interests are covered. Tours by appointment on at least one week's notice. Fee of $1.00 per person.

(16) Saugus Iron Works
244 Central Street
Saugus, MA 01906
(617) 233-0050
Pat Paulovich

Water power in the 1600's in a reconstructed iron works. Includes an iron works house, museum, charging bridge, blast furnace, forge, slitting mill and blacksmith shop. Reservations required — free, 45 minutes.

(17) Seabrook Station Education Center
P.O. Box 300
Seabrook, NH 03874
(603) 474-9521 ext. 2727

Nuclear power plant under construction. Exhibits explain generation of electricity by nuclear power. Wide variety of exhibits, many are participatory, help explain the salt marsh, ecosystem and the steps being taken to protect it. A computer quiz for self examination. Reservations required, free, 2½ hours.

(18) Springfield Science Museum
236 State Street
On the Quadrangle
Springfield, MA 01103
(413) 733-1194
Sara Orr — Education Department

Exhibits include steam engine, 1904 Knox automobile, 1937 Zeta airplane, etc. A 45 minute program "charge it" explores the basic nature of electricity and allows active student involvement. Fee.

(19) Old Sturbridge Village
Museum Education Department
Sturbridge, MA 01566
(617) 347-3362 ext. 316
Shirley Heck

How energy was used is shown in this recreated 19th century community. There is a working blacksmith shop and water wheels power the grist mill and wool cording mill. Open year round — group rates available and reservations required for school tours.

(20) Yankee Atomic Electric Company
Visitor Center
Rowe, MA 01367
(413) 625-6140 ext. 392
Sally Alix

Students view a film and hear and see how a reactor works and how electricity is generated in New England's first nuclear plant. Reservations required, free, ½ hour.

INDUSTRY AND NON-PROFIT SOURCES OF MATERIALS

The following are information and educational materials available from a variety of sources. Included are public and private agencies and organizations representing various interests in the field of energy. In some cases, we've cited a specific item or items to request. In all cases, we suggest you contact the source directly to obtain a listing and/or whatever material or information they have available. These can form a useful background resource for your classroom or school library.

*Denotes utility company: materials should be requested only from utility serving your school.

Alliance to Save Energy (ASE)
1925 K Street, N.W. Suite 507
Washington, D.C. 20006
(202) 857-0666

Provides consumers with methods of saving energy and promotes energy conservation.

American Gas Association (AGA)
1515 Wilson Boulevard
Arlington, VA 22209
(703) 841-8400

Provides information on all phases of gas production, distribution, transportation, and gas-related endeavors. Many of their publications are available through the local gas utility.

American Nuclear Energy Council
410 First St., S.E.
Third Floor
Washington, D.C. 20003
(202) 484-2670

Represents organizations interested in promoting nuclear energy as a source of energy. Provides information on issues and legislation.

American Nuclear Society (ANS)
555 North Kensington Avenue
LaGrange Park, IL 60525
(312) 253-6611

Membership is made up of nuclear scientists involved in the energy field. Its publications answer questions about nuclear energy.

American Petroleum Institute (API)
1220 L Street, N.W.
Washington, D.C. 20005
(202) 457-7000

Represents petroleum producers, refiners, marketers, transporters. Provides a wide range of publications on any topic concerning petroleum.

Amoco Teaching Aids — Energy
P.O. Box 1400K
Dayton, Ohio 45414

Provides information packet and listing of free and/or inexpensive material. "Living with Energy" for grades 7-9. Studies current energy problems using five spirit masters, activities and teachers instruction.

Antioch/New England Graduate School
Know Nukes Institute
Keene, NH 03431
Mitchell Thomashow, Coordinator

Trains teachers to introduce the nuclear power controversy into the classroom. Ask for "Know Nukes: A Nuclear Power Issues Curriculum Guide."

Atomic Industrial Forum (AIF)
7101 Wisconsin Avenue
Bethesda, MD 20814
(301) 654-9260

Made up of a wide variety of groups involved in the development and utilization of nuclear energy. Provides material on nuclear power generation.

***Boston Edison**
Public Information Department
800 Boylston Street
Boston, MA 02199
(617) 424-2448 Dena Lehman, Educational Services Coordinator

Electric utility providing wide variety of material, information, and help for the classroom teacher.

Center for Ecological Technology
148 First St.
Pittsfield, MA 01201
(413) 445-4556 Allan Silverstein, Associate Director

Resource library, slide shows, speakers.

Channing L. Bete Co., Inc.
200 State Street
South Deerfield, MA 01373
(413) 665-7611

Energy and resources conservation booklets. Single review copy free; quantity pricing on request; send for catalog.

Chevron, U.S.A., Inc.
Public Affairs, Youth and Education
P.O. Box 7753
San Francisco, CA 94120

Ask for "Energy Adventure" and/or "Career Awareness."

***Commonwealth Electric**
Consumer Relations Dept.
2421 Cranberry Highway
Wareham, MA 02571
(800) 642-7030 John Farnham, Manager of Consumer Relations

Electric utility provides educational materials and information.

Conservation Consultants
417 Thorn St.
Sewickey, PA 15143

Send for material listing; useful, inexpensive material.

Conservation and Renewable Energy Inquiry and Referral Service
P.O. Box 8900
Silver Spring, MD 20907
1-800-523-2929

Provides basic information and renewable energy technologies. Solar bibliography, free.

Cooperative Extension Service
215 Strockbridge Hall
U. Mass, Amherst, MA 01003
(413) 545-2716 Bob Schrader, Energy Specialist — or your county office.

Supplies "Energy Challenge", resources and teacher guide.

Edison Electric Institute
Dept. of Public Relations
1111 19th Street, N.W.
Washington, D.C. 20036
(202) 828-7400

An association of investor-owned electric companies providing information on topics concerning electrical energy.

***Eastern Edison**
Lincoln, RI
(401) 333-1400
Beverly Adamonis, Education Specialist

Electric utility — send for catalog.

Electric Power Research Institute
P.O. Box 10412
Palo Alto, CA 94303

The institute is funded by electric utilities. Provides information on solar, coal, geothermal, fusion, environmental impacts, and nuclear and fossil fuel generation.

Exxon Company, U.S.A.
Headquarters Public Affairs
P.O. Box 2180
Houston, TX 77252

Resource information and list of material.

***Fitchburg Gas and Electric Light Co.**
285 John Fitch Highway
P.O. Box 2070
Fitchburg, MA 01420
(617) 343-6391 Thomas Conray, Jr., Manager Community Relations

Catalog of energy materials.

Food for Thought — Books
67 N. Pleasant Street
Amherst, MA 01002
(413) 253-5432

Sells many energy related books.

Franklin County Extension Service
Courthouse, 425 Main St.
Greenfield, MA 01301
(413) 774-2902 or 2903
Gisela Walker, Extension Agent

Solar models available to schools: thermo-siphoning air panel; hot water system; solar oven; make music; make things grow. Curriculum materials — send for list.

Government Printing Office
Superintendent of Documents
Washington, D.C. 20402

Catalog of energy and other materials printed by Federal Government.

Hampshire Educational Collaborative
36 Hadley St.
The Center School
South Hadley, MA 01075
(413) 534-4563 Cecelia Scaife, Director

Energy resources and materials.

Hitchcock Center for the Environment
The Carriage House, Lerch Hill
525 South Pleasant St.
Amherst, MA 01002
(413) 256-6006 Peg McDaniels, Environmental Education Resource Center Coordinator

Good resource library.

Innovative Communications
2923 North Main St.
Walnut Creek, CA 94596
(415) 944-0923

Produces curriculum guides and aids.

League of Women Voters
1730 M. Street, N.W.
Washington, D.C. 20036

Listing of energy and citizenship publications.

Maine Audubon Energy Department
118 Route One
Falmouth, MA 04105

Solar energy materials: "Solar Concepts" a good unit for vocational education classes.

Massachusetts Audubon Society
Library
South Great Road
Lincoln, MA 01773
(617) 259-9500 ext. 7255 Tom Wellnitz, Energy Education Coordinator

Excellent resource including extensive materials for energy information and education, and copies of curricula mentioned in this guide.

Massachusetts Executive Office of Energy
Room 1500
100 Cambridge St.
Boston, MA 02202

Information on Massachusetts energy use and policy.

***Massachusetts Electric**
New England Power Service Co.
25 Research Dr.
Westborough, MA 01581
(617) 366-9011 Arthur Fox, P.E., Manager, Educational Services

Electric utility, providing wide variety of material, information, and help for the classroom teacher.

Merrimack Education Center
101 Mill Road
Chelmsford, MA 01824
(617) 256-3985 Jean Sanders, Ed D, Associate Director

Teacher developed units to be used with DATAPLOT or the NSTA software. Other energy related programs.

National Coal Association
1130 17th Street, N.W.
Washington, D.C. 20036
(202) 463-2625

A coal industry association offering a variety of publications on coal, including "Power From Coal", and informative booklets, teachers guide, and classroom activities.

National Geographic Society
Educational Services
Department 82
Washington, D.C. 20016
(202) 857-7378

Teaching units on energy.

National Science Teachers Association (NSTA)
1742 Connecticut Ave., N.W.
Washington, D.C. 20009
(202) 328-5800
John Fowler, Project Director

Teaching units and materials on energy.

National Wildlife Federation
1412 16th St., N.W.
Washington, D.C. 20036
(703) 790-4361

Energy related publications.

N.Y. Energy Education Project
SUNY At Albany
1400 Washington Ave.
Box 22100
Albany, NY 12222

Prepares curriculum guides.

***Northeast Utilities**
174 Brush Hill Ave.
W. Springfield, MA
(413) 787-9509 ext. 2294
Georgianne Grant, Education Coordinator

Electric utility provides energy education material through catalog.

Sierra Club
Information Services
530 Bush St.
San Francisco, CA 94108

Environmental advocacy organization with energy related publications.

Standard Oil Company (Indiana)
200 East Randolph Dr.
P.O. Box 5910-A
Chicago, IL 60680

Oil and energy information packet.

Standard Oil Company (Indiana)
Corporate Social Policy
MC-4308
P.O. Box 5910
Chicago, IL 60680

Career information, free.

Tenneco Inc.
Public Affairs Department
P.O. Box 2511
Houston, TX 77001

Send for material list and "A Guide to Information Sources".

Thomas Alva Edison Foundation
Cambridge Office Plaza
Suite 141
18286 West Ten Mile Rd.
Southfield, Michigan 48075

Publishes information on Edison's life and early generation of electricity.

U.S. Department of Energy
Public Information Office
150 Causeway St.
Boston, MA 02114
(617) 223-2525 Duane Day,
Public Information Officer

Information, publications.

U.S. Dept. of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

No material listing but will send packet of free material. Availability varies.

U.S. Department of Energy
Energy Information Administration
National Energy Information Center
E1-20, Forrestal Building
Washington, D.C. 20585

All areas of energy information and up-to-date energy statistics.

Worldwatch Institute
1776 Mass. Ave., N.W.
Washington, D.C. 20036
(202) 452-1999

Bi-monthly publications, informational booklets.